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A Randomized Controlled Trial Assessing the Impact of an Innovative Approach to Educating New to Practice Nurses

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A RANDOMIZED CONTROLLED TRIAL ASSESSING THE IMPACT OF AN INNOVATIVE APPROACH TO EDUCATING NEW TO PRACTICE NURSES

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Evelyn Lengetti

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ABSTRACT

A RANDOMIZED CONTROLLED TRIAL ASSESSING THE IMPACT OF AN INNOVATIVE APPROACH TO EDUCATING NEW TO PRACTICE NURSES

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Dissertation supervised by Rebecca Kronk, PhD, CRNP, MSN

Background/Purpose

Catheter associated Urinary Tract Infections (CaUTI) are preventable, and hospitals receive no additional reimbursement for these infections. The purpose of this study was to evaluate the effect of mastery learning compared to traditional learning on new nurses' skill acquisition and self-regulation practices for indwelling urinary catheter insertion.

Theoretical Framework

Mastery Learning posits that all learners have the potential to achieve mastery when given the time to learn along with deliberate practice and repetition. Traditional Learning, a more rote instructional approach, emphasizes memorization with a single summative assessment. Self-regulation signifies actions practiced by the learner to gain

new knowledge which is promoted when given deliberate feedback, a hall mark of mastery learning.

Methods

This randomized controlled trial was conducted in an acute care health system and collected outcome data at two points (immediately after the intervention and one month later). Participants, who were new to practice nurses, were randomized into the experimental (mastery learning and the control groups (traditional learning). All received baseline education on indwelling urinary catheter insertion before completing the procedure in the simulation lab. The experimental group was offered multiple attempts for insertion with deliberate practice, repetition and feedback. The control group was offered one attempt for insertion with feedback at the end. Paired t-tests compared: 1) the mean change in initial and one-month skill acquisition scores within groups measured on the Performance Assessment Tool (PAT), and 2) self-regulation practices for both groups using the Survey of Academic Self-Regulation (SASR) questionnaire one month post-intervention. An independent t-test compared the mean change in skill acquisition scores measured on the PAT scores between groups at one-month.

Results

The mean change in the initial and one-month skill acquisition scores within groups was not significant for either group: control, $p = .128$ and experimental, $p = .275$. The mean change in the initial and one-month skill acquisition score between groups was not significant, $p = .063$. A comparison between groups exclusively on those procedural steps deemed critical (potential to cause harm) was significant: the experimental group

scored significantly higher, $p = .013$. The mean SASR scores between groups was significant, $p = .035$.

Conclusion

Although the difference in PAT initial and one-month post intervention scores both within and between groups were not significant, we cannot forego the need to continue to test and explore teaching strategies that promote clinical competence. Of importance is the retention of the seventeen critical steps retained by the experimental group. The retention of these steps was significantly greater in the experimental group as compared to the control. This finding is important because, if performed incorrectly, these steps will cause harm to the patient. The mean SASR score for the experimental group was greater than the mean for the control group suggesting that nurses in the experimental group, who received corrective feedback repeatedly for those critical steps, have a greater propensity for applying study strategies to help maintain skills acquisition and competence. Findings serve as a new nursing pedagogy.

DEDICATION

I dedicate my dissertation to my parents who through their unending support and confidence in my ability to succeed, have gently guided me in spirit.

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I would like to thank my dissertation committee who each provided guidance and support in a way that was both unique and personal. To my dissertation chairperson, Dr Rebecca Kronk, who helped me to stay on track and always believed in my ability to succeed every step of the way. Thank you for helping me to achieve my goal. To the members of my dissertation committee who provided me with the guidance I needed to successfully complete my work. To Dr. Dean who was a sweet and gentle mentor who supported me through personal changes without ever needing to ask! To Dr Moss who through her knowledge and expertise in the field of education, helped me to refine my topic and sparked my interest in educational psychology. To Dr Cantrell, my personal friend, no words can describe how thankful I am for your friendship and professional mentorship, I am forever grateful to have you in my life. I would also like to thank all the faculty and staff of Duquesne University School of Nursing who have collectively assisted me in my doctoral studies. I learned something different from each professor which has provided me a well-rounded and diverse perspective of the profession of Nursing.

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Chapter 1

INTRODUCTION

1.1 Problem

Mastery learning and self-regulation have predominantly been reported in education literature yet have applicability to any environment that requires instructions to be taught to a learner. Although Mastery Learning was reported in the education literature in 1960s, its application to healthcare education has been published only recently (McGaghie, Issenberg, Barsuk, & Wayne, 2014) and very little evidence specifically on its impact within nursing education has been reported. The review of the evidence for mastery learning and self-regulation emphasizes the gap in the literature supporting the application of these theories to nursing education. This gap supports the rationale for further research and testing of the effect these theories have on improving nursing competence. Conducting educational research on the application of a teaching strategy, mastery learning, and its influence on self-regulation practices might serve as a foundation for how we teach nursing practice. The end result could be the creation of a standard for how nurses are educated on key nursing actions in an effort to achieve clinical competence and improve patient care and clinical outcomes which is an imperative in today's healthcare environment.

1.2 Significance

Competence requires a cognitive connection between what is taught and what is experienced (Eraut, 1998). A traditional learning approach focuses primarily on the content to be taught with an emphasis on memorization and less on student and teacher interface (Khalid, 2012). Mastery Learning fosters a cooperative environment between

the instructor and the learner whereby individualized feedback on performance is provided (Guskey, 2010). The instructor can choose to use a variety of teaching strategies and formative assessment techniques to enhance the experience of the learner and optimize the learning potential (Guskey, 1980). "To ensure alignment among instructional components, teachers must make a number of crucial decisions. First, they need to decide what concepts or skills are most important for students to learn and most central to students' understanding" (Guskey, 2007, p. 20). It is in this alignment that there is an application to nursing education in that identifying those skills or competencies that are most important to assuring high quality patient care, could be taught using mastery learning principles. Self-regulation habits are also promoted through formative assessments because they help the student adjust their study tactics to improve performance (Nicol & Macfarlane-Dick, 2006). Mastery learning as an instructional approach may have a significant impact on the nurses' use of self-regulation strategies that result in improved patient care and patient outcomes.

This research study focuses on the clinically significant patient condition: Catheter associated Urinary Tract Infections (CaUTI), a significant patient safety concern and a challenge for healthcare providers. These infections account for 30% of all hospital acquired infections annually (Centers for Disease Control and Prevention. Healthcare Infection Control Practices Advisory Committee (HICPAC) retrieved from: http://www.cdc.gov/hicpac/CAUTI_fastFacts.html). One CaUTI can cost as much as $758.00 (Anderson et al., 2007). These infections are considered preventable by the Centers for Medicare & Medicaid Services (CMS), and hospitals are not reimbursed for patients with this Hospital-Acquired Condition (HAC) (Institute for Healthcare

Improvement (2010) (retrieved from: http://www.ihi.org/topics/CAUTI/Pages/default.aspx). Of importance, infections are most often related to the initial insertion of the catheter. This insertion procedure is usually performed by the registered nurse and is therefore classified as a nursing quality indicator by the American Nursing Association (ANA), (retrieved from: www.cdc.gov/hicpac/CAUTI_fastFacts.html).

Standardizing clinical practice for the insertion of an indwelling urinary catheter is a clinical imperative. A review of healthcare quality data, nursing observations and anecdotal reports showed inconsistencies in the practice of insertion of an indwelling urinary catheter among nurses. These inconsistencies may be a contributing factor to the overall infection rates. Education that promotes adherence and standardization in clinical practice for the insertion of an indwelling urinary catheter may reduce infections and improve patient care and clinical outcomes while reducing the cost to provide care.

1.3 Purpose and Aim

The purpose of this dissertation research study was to compare the impact of two instructional approaches (mastery teaching and traditional teaching) on the learner's ability to maintain competence for the psychomotor skill of inserting an indwelling urinary catheter in a simulated environment. In addition, this study compared the frequency of using self-regulation as a strategy for maintaining competence for this psychomotor skill. Self-regulation was measured by *The Survey of Academic Self-Regulation (SASR) Questionnaire.*

1.4 Operational Definitions

1.4.1 Traditional Learning. Traditional learning is most often instructor lead with a single assessment of a student's performance (Guskey, 2010). A traditional learning approach focuses on the content to be taught with an emphasis on memorizing key concepts. It is often described as rote instruction that is focused more on content delivery and less on student engagement and teacher interaction (Khalid, 2012) striving to accomplish learning outcomes in a fixed amount of time (Roberts, Ingram, Flack, & Jones Hayes, 2013). Traditional learning is often lecture-based making the learning environment less interactive, not student centered and a less motivating approach to teaching (Crandall, Reboussin, Michielutte, Anthony, & Naughton, 2007). A summative assessment of student performance and achievement is accomplished at a predetermined end point (Guskey & Jung, 2011) and serves as a single measure of achievement obtained at the conclusion of the learning activity (Iwasiw, Goldenberg & Andrusyszyn, 2009).

Traditional learning marks achievement with a grade level, for example A, B or C (Guskey & Anderman, 2013). Bloom (1968) attested that academic achievement of a traditional class will follow the distribution of a normal curve with only 10% reaching achievement or failure and the remaining 80% somewhere in between. He believed that educators should be focused on changing that outcome and striving to promote a higher percentage of achievement. Bloom (1968) also declared that 90% of a class can master content taught but it is the responsibility of the teacher to provide ample time and instruction that is individualized to the learner. Combining the 5% of the gifted student with the 90% who do not fail, a total of 95% of a class should be able to master content

taught. It is understood that some students will take more time and effort but an individualized approach to teaching will promote mastery of this larger percentage.

1.4.2 Mastery Learning. Mastery Learning was first reported by Carroll (1963) and then Bloom (1968) as an instructional approach that promotes success among the majority of the students. The principles of mastery learning theory include: (1) clearly defined goals, (2) instructions that result in proficiency, (3) formative feedback that affirms what was performed correctly and remediates what was not, and (4) evaluation (Guskey, 2007). Time is a key factor to consider when utilizing this teaching strategy in that each learner has the potential to achieve mastery provided they have the time required for them to learn at their own pace. Each student learns at an individual pace with some achieving mastery quicker than others (Bloom, 1968). The only student excluded from this statement is the student with a specific disability for example, "The tone deaf individual will have great difficulty in learning music" (Bloom, 1968, p. 3).

This theory thoroughly explains how each of the essential concepts relates making it easy to predict expected learner outcomes (Polit, & Beck, 2012). Although this theory is not a nursing theory, it might be considered a situation-specific theory in that it focuses on the relationship between the concepts and makes a deductive prediction about the outcome (Meleis, 2007).

1.4.3 Self-Regulation. Self-regulated learning is a reflection of the personal strategies a learner uses to prepare for a learning activity. It involves more than detailed knowledge of a skill. It involves the self-awareness, self-motivation, and the behavioral competence to attain the desired information (Zimmerman, 1989) and may be exemplified by actions such as seeking and organizing information, rehearsal or getting

assistance from others (Zimmerman & Pons, 1986). Self-regulated learning is not another learning experience, it is a process in which students engage as a way of monitoring and motivating themselves to achieve their personal learning goals (Boekaerts & Cascallar, 2006).

The initial phase of self-regulation is called forethought. This is the starting point for the learner to apply personal beliefs about the goals and expected outcomes of the learning activity. The second phase, performance control, is characterized by the actions identified by the student to complete the tasks required to meet personal learning goals, self-assess of the ability to accomplish the goals, and engage in performance monitoring. The final phase, self-reflection, is an introspective assessment of performance evaluated against the expected goals and outcomes. This total process is cyclical and while the last phase evaluates performance against the learning goals set during forethought, the student's judgment and reactions to personal achievement may force the learner to initiate another cycle starting with a revised forethought (Cleary & Zimmerman, 2004; Dunn, Osborne, & Link, 2012). The evaluation process is essential for future efforts in that how the student judges the current performance provides helpful feedback to frame the forethought phase of the next learning task (DiBenedetto & Zimmerman, 2013).

1.5 Background

1.5.1 Traditional Learning. A comparison of distance learning and traditional learning environments and the impact on student satisfaction and achievement outcomes was conducted by Lyke and Frank (2013). Student satisfaction for distance learning compared to traditional had mixed results suggesting that satisfaction is a "multidimensional construct" (p. 246) thus sparking the interest in this comparative

study. The 69 consented undergraduate students who were studying psychology, self-selected into two groups: the control (traditional) and the experimental (online). To assess subject matter knowledge, both groups received the same 10-question multiple choice quizzes at the end of each session. At the end of the course, student satisfaction for both the learning environment and the instructor was assessed using a standardize instrument called the Individual Development Education Assessment (IDEA) (retrieved from http://www.ideaedu.org/services/student-ratings). The aggregate scores of the traditional learning group rated satisfaction with the course and instructor higher than the distance learning group. There was no significant difference in the overall quiz scores for both groups (Lyke & Frank, 2013).

Crandall et al. (2007) shared an interest for medical students' attitude toward care of the medically indigent patient while in a four-year medical education program. This longitudinal prospective cohort study of 110 medical students, tested and compared the impact of a traditional instructional approach to problem based learning when teaching this empathic skill. Traditional learning was described as lecture based and problem-based learning (PBL) defined as more interactive and student focused. Crandall and colleagues hypothesized that at the start, all students would have similar attitudes toward caring for this population, but those students who learned in a PBL environment would complete the four-year program with a "more favorable attitude" for caring for this underserved population with female students surpassing males. A review of the Medical Student Attitude Toward the Underserved (MSATU), a questionnaire completed voluntarily at various intervals over the four years, confirmed that all students expressed a more negative attitude for this population at the completion of the program when

compared to their feelings at the start. There was no difference between the teaching approach (traditional learning vs problem based) and gender (female vs male).

1.5.2 Mastery Learning. Forty-two pediatric medical residents participated in a multi-center prospective randomized study. Participants were taught Neonatal Resuscitation and Pediatric Advanced Life Support skills according to the American Heart Association guidelines using simulation based mastery learning (SBML) principles and were deemed to have mastered the skills taught at the end of the initial session. All participants were then randomized into three groups to be evaluated at either two months, four months or six months post intervention at which time the same skills were evaluated for mastery level performance. Skill retention declined significantly from two months to six months post intervention. This study affirmed that further exploration of skills retention over time as well as quantity of time in a SBML teaching session was necessary. There was no significant difference in performance based on clinical years of experience (1 year versus 3 years) (Braun et al., 2015).

A Realist Synthesis review of 14 studies explored the impact of simulation based mastery learning (SBML) on clinical and performance outcomes of the learner and addressed who, what, where/circumstances, why and how SBML was effective (Griswold-Theodorson et al., 2015). The researchers' analysis confirmed that SBML had a positive impact on clinical performance. Of note was the effect on technical/procedural skills resulting in improved patient comfort, accuracy of procedural performance and success rate, decrease in procedural errors, and reduced time to complete procedures. Griswold-Theodorson et al confirmed that this level of clinical competence has the

potential to directly affect the overall cost to provide care (Griswold-Theodorson et al., 2015).

Two prelicensure nursing programs expressed concern for both faculty availability and practice time for students to mastery the skill for nasogastric (NG) tube insertion. Recognizing that clinical competence was achieved when both feedback and ample time to practice was provided, Carson et al. (2015) paired nursing students into a cooperative learning dyad using the Cooperative Learning Simulation Skills Training method during a simulated exercise for practicing NG tube insertion. The Associate Degree in Nursing (ADN) program had a total of 134 students and the Bachelors Degree in Nursing (BSN) program had 52. The student dyads ranged from six to 15 depending on the program. Students were given time to master the skill measured by achieving 100% on the assessment tool. This team measured the effectiveness of cooperative learning and "deliberate-practice-to-mastery" (p. S48) as a way to improve competence for this nursing skill while minimizing the impact on faculty instruction time. The major difference between the groups was that the ADN student had three practice sessions while the BSN program only had two. All students validated a feeling of preparedness to complete this skill and expressed satisfaction for working in a dyad (Cason et al., 2015).

A qualitative review of 23 studies was conducted by McGaghie et al. (2014). This review concluded that a mastery learning approach to teaching is more effective in promoting adherence to evidence based practice standards as compared to a traditional approach with the greatest effect being recognized when mastery learning is applied repeatedly. The ability to follow evidence based standards of care promotes improved patient centered outcomes and reduces costs by minimizing poor outcomes as a results of

not following the standards of care. This proves to be the greatest long-term benefit of teaching in this manner.

Cook, Brydges, Zendejas, Hamstra, and Hatala (2013) conducted a meta-analysis that summarized the outcomes of 82 studies that tested the effectiveness of simulation based mastery learning (SBML) as compared to no intervention on competency based education of doctors, nurses, and other healthcare providers. This analysis showed that in 41 of the studies, SBML has a large effect on skill acquisition (ES) 1.29, and 11 of the 82 studies confirmed a moderate effect on patient outcomes, (ES) 0.73. Only three studies reported that learning had a greater impact on clinical performance and competence than non-mastery learning. These authors recognized the additional instructional time needed to deliver SBML activities and for the learner to complete repeat performances until competence was achieved.

Forty-seven first year internal medicine residents participated in a simulation based mastery learning (SBML) program which taught intensive care procedural and communication skills in a study conducted by Moazed et al., (2013). Initial training was conducted in the simulation lab and included a blend of didactic presentations and procedural skills all of which were required to be achieved at a mastery level. Of the initial 47, 42 participants received a 15 minute refresher (booster) simulation just prior to the intensive care clinical rotation to reassess clinical competence. The retention of these skills was measured again four weeks into this clinical experience on an actual patient. The reassessment timeframe ranged from 1 month to 12 months post initial intervention because of the method of clinical rotation scheduling. All residents maintained mastery level competence at this reassessment. This study provided empirical evidence of the

effectiveness of SBML and a refresher or booster session at the start of the clinical rotation as a method of transferring knowledge from an initial simulated training to direct patient care. The reported finding of the reassessment timeframe (1 month -12 months) did not demonstrate a statistically significant difference in performance. Moazed et al. emphasized the importance in spending the time necessary to teach to mastery at the start of a clinical experience in that the retention of the skill when at the bedside later in the clinical rotation is retained (Moazed et al., 2013).

In a study conducted by Wu, Hwang, Su, and Huang (2012) a comparison of 46 nursing students taught how to complete a physical assessment of the respiratory system randomized to either the mastery learning (experimental group) to traditional learning (control group) groups was reported. The study used computer technology to augment mastery learning teaching as a cost reduction approach. This study concluded that the students in the experimental group had significantly better overall achievement in the class and a more positive attitude toward the experience as compared to the control group confirming the benefit of mastery learning as a teaching approach.

An observational cohort study comparing simulation-based mastery learning (SBML) and traditional teaching was conducted testing 103 medical residents and their ability to insert of a central venous catheter. Twenty-seven residents received a traditional approach during the pre-intervention phase of the study. Seventy-six were taught using a SBML approach. Procedural confidence was not significantly different between groups but the SBML group demonstrated mastery level competence for insertion of a central venous catheter with a significant reduction in procedure related complication when providing direct patient care (Barsuk, McGaghie, Cohen, O'Leary, & Wayne, 2009).

1.5.3 Self-Regulation. Jouhari, Haghani, and Changiz (2015) conducted a qualitative study exploring what medical students believe are of help and hinder self-regulation practices. This purposive sample of students, with varied grade point averages, was consented based on their knowledge of self-regulated learning. Data collection consisted of 21 recorded interviews of 19 students (two interviewed twice), asking the initial question of "What factors affect your self-regulation in learning?" (p. 2). As a result of this qualitative investigation, the research team identified the following themes as having positive effects on self-regulation: family and peer support, instructor knowledge and enthusiasm, and an appealing learning atmosphere. The study participants also confirmed their personal responsibility for both motivation and self-efficacy as positive contributors to self-regulation practices. Anxiety and stress were examples of factors that prohibit the use of self-regulation as reported by the students.

In an effort to develop both computer and problem-solving skills of 279 second-year students at a university in Taiwan, Tsai (2013) compared the final grades for students taking an on-line course on computer skills for web design. Consented participants were randomized into five groups. Four of the groups received a variation of both collaborative learning and self-regulation (experimental groups) and one group received traditional instruction (control group). Collaborative learning for this study was defined as group based activities that promoted both individual learning and group participation. In an effort to assist students who may struggle with the open structure of an on-line learning environment, the intent of this author's application of self-regulation was to enhance the students overall learning by fostering their learning preferences as well as providing direct feedback on performance. Traditional teaching methods were

defined as a blended learning environment without collaborative learning and without self-regulated learning. The group that received collaborative learning with instructor's support at the start of the class and self-regulated learning with instructor feedback outperformed the other groups. Those who received traditional instruction performed the worse.

Based on the assumption that physicians will alter their clinical practice when they personally identify their own learning gaps through reflection, Mamede et al. (2013) conducted a study on 165 general medicine practitioners in a continuing medical education program in Brazil investigating which variables affect learning and clinical performance. A 30 item questionnaire which assessed such variables is individual reflection, peer review and self-regulated learning, and clinical performance test was distributed to all participants. This study concluded that a reflection on personal experiences, as a method of evaluating real-time clinical practice and identifying gaps in knowledge, was the preferred strategy to improve professional practice. This approach to learning relies on the practitioners' ability to self-regulate which includes identification of learning goals and outcomes, strategies to achieve those goals and evaluation of expected outcomes. The outcome of this study, particularly with regard to the impact on self-regulation, was not significant for "identifying" clinical learning gaps but was significant for its influence on practitioners' use of self-study strategies such as reading scientific literature.

Baack and Alfred (2013) examined the multiple contributors to perceived competence and nurses' preparedness when managing a disaster with self-regulation being just one of the predictors. Self-regulation in this study was defined as self-

motivation to take action in an emergency and was measured using a three question survey focusing on the participants "engagement in disaster preparedness activities" (p. 283) and exploring the nurse's likelihood, commitment or willingness to participate in a disaster. The authors acknowledge that the evidence is inconclusive in determining the best educational approach to assuring competence as measured by knowledge and skills in a disaster yet experience in an actual disaster improved confidence. Of interest was the positive impact the self-regulation had on nurses' willingness to participation a disaster.

In a research study conducted by Bembenutty and White (2013) 133 college students participated in a study to explore factors that influence learning, specifically self-efficacy, intrinsic motivation and help-seeking strategies. The data confirmed that self-efficacy, belief in one's ability to succeed at the specific task at hand, and intrinsic motivation, behavior that is driven by internal drive rather than influenced by external rewards, both had a positive impact on overall performance. The use of homework logs was also reported to positively influence students' self-regulation strategies. In addition, help-seeking, which is also a self-regulation strategy, positively impacted overall performance.

Dunn, Osborne and Link (2011) explored the performance and self-reflection phases of the self-regulation process used by 72 undergraduate nursing students to determine the fundamental attributes, termed causal attributes, with greatest influence. Attributes such as, ability and effort, were tested for their impact on a student nurse's use of self-regulation and their ability to learn pathophysiology. This research group determined that causal attributes of luck, ability and effort all impacted the students' use of self-regulation with ability having the greatest effect. They emphasized the need for

teachers to test their teaching strategies and the influence those strategies have on assisting the student to master content using self-regulation tactics.

1.6 Synthesis of the Literature

The limited current research testing traditional learning was primarily a comparison of a traditional classroom environment and online or distance learning. This research was conducted in the field of education with no recent findings in healthcare literature. The majority of the publications reporting the effectiveness of mastery learning as an instructional approach are in the fields of Education, Education Psychology and Psychology. There is a recent surge in healthcare literature but primarily testing physician education and not nursing. While many studies are a testament to the effectiveness of mastery learning, the gap remains in the determination of the effect of mastery learning on nursing competence and confidence as compared to traditional teaching strategies as well as the potential impact on patient outcomes and cost. With the exclusion of one article published by Wu, Hwang, Su & Huang (2012), there is a significant gap in the nursing literature.

Current literature provides many sources of evidence that the application of self-regulation strategies improves the learner's academic achievement yet little is reported outside of a traditional school setting. There is no evidence that reports the influence of mastery learning as an instruction approach on the use of self-regulation practices. The issue of concern and question is determining the difference between instructional approaches (mastery and traditional) and the application of self-regulation habits as a method of maintaining competence.

1.7 Application to Nursing Practice

Nursing competence requires a cognitive connection between what is taught and what is experienced (Eraut, 1998). Mastery learning fosters a cooperative environment between the instructor and the learner that enhances this experience. The instructor can choose to use a variety of teaching strategies to enhance the experience of the learner and optimize the student's learning potential (Guskey, 1980) assuring that learning objectives and expected outcomes are aligned with the critical content (Guskey, 2007). It is in this alignment that there is an application to nursing education. Identifying the clinical practices that pose the greatest risk of patient harm if performed incorrectly is a starting point. Through this cooperative learning environment, mastery learning has the potential to significantly impact nurses' clinical competence resulting in improved patient care and clinical outcomes.

The specific elements of self-regulation are agreed upon by education experts yet measuring the actual habits a student uses has been challenging (DiBenedetto, 2011). Self-regulation is not simply a trait that individuals either possess or lack; but more of an ability to personally adapt a skill or process to address a specific learning need (Schunk & Zimmerman, 1997). In addition, because of inexperience, novices often lack the skill to align tasks with learning needs (Kostons, van Gog, & Paas, 2012) therefore, the introduction of self-regulation strategies may assist new to practice nurses to identify and employ effective habits to achieve and maintain clinical competence.

1.8 Preliminary Studies

At The Children's Hospital of Philadelphia (CHOP), an IRB approved research study testing the effectiveness of just in time and just in place simulation training on

central venous catheter dressing changes practice was conducted. Study participants totaled over 500 nurses working on various inpatient clinical units. This study consisted of an administrator and two masters prepared nurses who utilized a cart equipped with task trainers (Chester Chest and an Arm) and all necessary supplies to allow each nurse to complete a dressing change in situ (on the clinical units). Performance was monitored and documented on a checklist created from the central venous catheter dressing change procedure. The initial focus was to allow each nurse one practice session on the task trainer with remediation as necessary for steps performed incorrectly yet the impact to practice was not evident until the focus of the training session was to train to excellence (defined by zero prompts/remediation to complete the skill correctly). A train to excellence approach proved to be successful in that there was a significant improvement in both nursing confidence for the skill assessed by a pre and posttest of knowledge for the procedure and competence for preforming the skill both simulated and on the patient. A post hoc review of the literature highlighted Mastery Learning Theory, which was not known at the initiation of the study, as a teaching approach consistent with the train to excellence strategy. While the train to excellence approach was consistent with some of the principles of this theory, it was not reported as such to the study participants during this study. The significance of choosing this skill was its association to the rate of central line associated blood stream infections (CLABSI). It is reported that CLABSI, one of many hospital acquired conditions, is the cause of 4000 deaths annually resulting in increased patient days at a cost as high as $30,000 for each preventable infection (Miller-Hoover & Small, 2009).

At CHOP, the Central Venous Catheter (CVC) dressing change procedure required two professionals: one to complete the procedure and one to monitor adherence to the procedure. The same performance monitoring tool used for the study was used to assess nursing competence at the bedside when completing this procedure. Providing this performance monitoring tool at the point of care is also considered a reference tool which promotes a self-regulation action by the nurse caring for the patient in that it promotes a comparison against the practice standard (Zimmerman, 2002). Nurses who participated in this educational intervention required fewer prompts then non participants, when providing direct patient care ($p<0.001$). The result of this initiative contributed to a decrease in CLABSI from 5.3/1000 to 2.9/1000 line days ($p<0.001$) and 173 fewer patients acquiring infections (Scholtz, Monachino, Nishisaki, Nadkarni, & Lengetti, 2013).

A pilot study (not published) was conducted at CHOP, Department of Nursing Education. The study duplicated components of the educational intervention used in the CLABSI study (Scholtz, et al, 2013), but applied simulation based mastery learning when teaching nurses how to insert an indwelling urinary catheter. Retention of this skill was measured at six months post intervention. In addition to skill retention, other demographic information was evaluated for the potential impact of retention and competence.

Data analysis concluded that employment status and skill retention was not significant, ($p = 0.20$) therefore confirming that the number of hours worked each week does not affect retention. Seven of the pilot study participants reported that they had placed an indwelling catheter in a patient during the time frame between the intervention

and the six month reassessment. This was also not significant, (p = 1.00) as well as years of clinical experience in the job was not significant, (p = 0.26). The only variable that was slightly significant was completing a computer based self-learning module prior to the six month assessment, (p = 0.053). Referencing the self-learning module prior to the six month reassessment can be considered a self-regulation strategy.

In a study conducted at The Children's Hospital of Philadelphia a multidisciplinary team investigated the retention of 2-rescuer pediatric cardiopulmonary resuscitation (CPR) according to the American Heart Associate 2005 guidelines. A group of 89 participants (medical residents and non-ICU nurses) were randomized to four groups each receiving a different teaching strategy. The primary goal of this study was to determine which teaching strategy was most successful in promoting skill retention. Participants CPR skills were measured at four intervals; immediate, one-month, three-months, and six-months post intervention. All participants received a "booster" training at all assessment intervals in the same instructional approach as the initial instruction: instructor only feedback, automated defibrillator feedback only, a combination of both automated and instructor feedback, and no structured training at all. At the one-month assessment, all groups required immediate re-education because retention across groups was so poor. It was at the three month assessment point when a significant improvement in skills retention was noted (p =.02). The greatest retention was observed at the six-month assessment where "…subjects were 2.9 times more likely to retain their skills (95% Cl: 1.4-6.2; p = .005)" (Sutton et al., 2011, p. e149). The study findings also concluded that the instructor only group had greater skill retention compared to the study

group receiving automated defibrillator feedback only with a p =.043. No other instructional comparisons were significant (Sutton et al, 2011).

1.9 Research Questions

Research Question 1: In practicing nurses, what is the impact of two instructional approaches (mastery teaching and traditional teaching) on the nurse learners' ability to maintain competence for the psychomotor skill of inserting an indwelling urinary catheter in a simulated environment?

Research Question 2: In practicing nurses, what is the frequency of using self-regulation as a strategy for maintaining competence for the psychomotor skill of inserting an indwelling urinary catheter in a simulated environment?

Research Question 3: Does the frequency of using self-regulation strategies vary with the type of instructional approach?

1.10 Summary

The long-term objective of this research study was to apply the findings and results to how nurses are educated. Conducting educational research on the application of a teaching strategy, mastery learning, and its influence on self-regulating practices might serve as a foundation for how we teach nursing practice standards and procedures. Patient conditions are complex and require astute competent healthcare providers that can adjust and adapt to a dynamic environment. It is impractical to exercise a traditional approach to teaching which relies entirely on direct patient care experiences as the primary training tool. This outdated teaching strategy is unable to assure clinical competence (McGaghie, 2015). Teaching healthcare professionals by using the approach of "see one, do one,

teach one" is no longer the most effective method of instructing others (McGaghie et al., 2014, p. 378).

In an effort to impact clinical reasoning and problem solving when providing care to patients, introducing the theory of self-regulation when teaching both nursing students and practicing nurses is essential. Evidence supports that self-regulation strategies help improve both students and practicing nurses cognitive and metacognitive skills when in a clinical practice environment (Kuiper & Pesut, 2004). Instruction using mastery learning principles and the promotion for self-regulation habits has the potential to assist new nurses to learn basic nursing skills first and then build on these skills in an effort to promote clinical competence. The introduction of mastery learning into nursing education may influence the nurses' ability to recognize when to use self-regulation skills, such as seeking assistance, referencing a procedure or rehearsing a nursing action prior to providing care. This approach fosters confidence and an eagerness to engage in life-long learning and intrinsic motivation to ask for help when challenges arise (Tuttle, Sherrod, & Canzona, 2008), which is also a self-regulation strategy (Zimmerman & Pons, 1986). Overall, it may also improve nursing competence and impact the quality of patient care delivered.

The end result could be the creation of a new standard for how nurses are educated on key nursing practices which impact patient care and clinical outcomes (Dougherty & Conway, 2008). The application of these research findings may underscore the effectiveness of Mastery Learning as a teaching strategy, and the influence it has on promoting self-regulation, are imperative because of the potential of not only improved patient care but also the possibility for reducing cost to deliver care (McGaghie, Barsuk,

& Wayne, 2015). The translation of this research to patient care practice is an imperative in today's dynamic healthcare environment. This quantitative study can contribute to the development of relevant knowledge in this area.

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Chapter 2

2.0 THEORY ANALYSIS

Manuscript #1

A THEORY ANALYSIS OF MASTERY LEARNING AND SELF-REGULATION

Formatted for publication and currently under review

2.1 Abstract

To examine the applicability of Mastery Learning and Self-Regulation theories to nursing education applying Walker and Avant's (2011) Strategies for Theory Construction in Nursing was used as the framework for the analysis. This analysis may serve as a foundation for an innovative, evidenced-based approach to teaching nursing practice resulting in improved patient outcomes.

Mastery Learning promotes a teaching approach to support achievement of skills taught and Self-Regulation describes individual actions demonstrated by the student that promote learning. The effectiveness of Mastery Learning has been documented in current healthcare literature with an emphasis on physician education. Research on Self-Regulation, primarily conducted among students from middle-school through graduate education, confirms that Self-Regulation strategies can enhance skill development and promote job performance.

This analysis supports the applicability of Mastery Learning and Self-Regulation Theories to nursing education practices. Conducting educational research on the application of Mastery Learning theory and its influence on nurses' Self-Regulating practices might reveal a new standard for how nurses are educated to improve patient care outcomes.

2.2 Introduction

The incidence of deaths due to medical errors was estimated to be 44,000 to 98,000, which prompted the Institute of Medicine's (IOM) report, To Err is Human (Kohn, Corrigan & Donaldson (2000). Recognizing that there is no one answer or solution for preventing injuries and deaths from medical errors, the IOM report urged health care professionals to explore strategies to decrease or eliminate practices that lead to errors that harm patients. Injuries and deaths caused by medical error also contribute to rising healthcare costs. Thus developing effective methods to improve patient outcomes and minimize medical errors are critical (Disch, 2012).

A collaboration between the Institute of Medicine (IOM) and the Robert Wood Johnson Foundation (RWJF) created a single committee of experts, the RWJF Initiative on the Future of Nursing at the IOM, to address four issues and to make recommendations for change. The issues are: (1) role of nurses; (2) shortage of nursing faculty; (3) focusing on the delivery of nursing services; and (4) attracting and retaining nurses. Seeking input from this multidisciplinary panel of experts, the IOM convened the Committee on the Robert Wood Johnson Foundation (RWJF) Initiative on the Future of Nursing at the Institute of Medicine (IOM, 2011) to address matters of concern facing the nursing profession and to transform the way Americans receive health care. In response to this need, three public forums where conducted, focusing on acute care, community care, and nursing education (IOM, 2011).

The Forum on the Future of Nursing: Education "…focused on three broad, overlapping subjects: what to teach, how to teach, and where to teach" (IOM, 2010, p. ix). This committee conducted "three armchair discussions" which focused on what to

teach in nursing curriculums; how to teach using partnerships and collaboration with attention to methodologies and teaching strategies; and where to teach promoting the use of technology (Shalala, et al. 2010).

An earlier IOM report, Health Professions Education: A Bridge to Quality (IOM, 2003), emphasized the imperative to include quality and safety in nursing school curricula. This report defined core competencies for nursing: patient-centered care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics. In response to the IOM Health Professional Education report, Robert Wood Johnson funded a collaborative of 15 schools of nursing, titled the Quality and Safety Education for Nurses (QSEN) Initiative, to identify, define and describe the essential features of the IOM competencies, (Cronenwett, Sherwood & Gelmon, 2009; Disch, 2012). The result of the QSEN Initiative was a set of statements of the specific knowledge, skills, and attitudes (KSA) for each competency that should be part of all pre-licensure nursing education programs (Cronenwett, et al., 2007).

Although these standards for competency have been tested and implemented in higher education programs the application of these competencies in nursing education beyond academic settings requires further support (Bednash, Cronenwett & Dolansky, 2013). Incorporating these competencies into hospital based education programs would bridge the transition from the classroom to the bedside for new to practice nurses. As professional nurses' ability to demonstrate competency in clinical skills increases, so does their ability to affect high-quality patient care outcomes (Brady, 2011). Angel, Duffey and Belyea, (2000) emphasize the mandate for changes in how nurses are educated to be grounded in the evidence. The vast amount of knowledge bestowed on

nursing students require nursing educators to explore methods of teaching that improve knowledge retention as well as promote critical thinking and improved patient outcomes (Angel et al., 2000).

Traditional instruction in the form of an instructor-led program with a single summative assessment is one method of teaching (Guskey, 2010) and is the most common approach to teaching. As an alternative to traditional instruction, Mastery learning fosters a cooperative environment between the instructor and the learner. Mastery learning is the deliberate practice and repetition of the skills not yet achieved by the student during a process in which the instructor feeds the learner forward with specific insights based on the learner's current performance. The instructor can use a variety of teaching strategies to enhance the experience of the learner and optimize the learning potential (Guskey, 1980). Self-regulation strategies are actions performed by the learner to gain knowledge such as setting learning goals, seeking and organizing information, getting assistance from others, or as complex as a rehearsal during which the learner monitors and improves the quality of the performance (Zimmerman & Pons, 1986).

Angel and colleagues (2000) posit that it is not the instructional approach alone that results in knowledge acquisition; individual learner's behaviors play a significant role in the achievement of learner outcomes also. Nurse educators who apply mastery learning theory as an instructional approach may foster a greater use of self-regulation behaviors demonstrated by the student. Such strategies may foster and maintain competence for what was taught by promoting the motivation and confidence to seek out information or ask for assistance prior to providing care. Collectively, this practice may

add value to the quality of patient care delivered and improved patient outcomes as shown in Figure 1. The Integration of Nursing Education, Mastery Learning Theory, Self-Regulation, Quality Care and Improved Patient Outcomes.

The purpose of this paper is to generate a new pedagogical approach for educating nurses by conducting a formal theory analysis of Mastery Learning Theory and Self-Regulation Theory to assess their usefulness and applicability to nursing education. The application of Mastery Learning and Self-Regulation, as a combined approach to educating nurses, could have a positive effect on nursing practice and improve patient outcomes.

2.3 Theory Analysis

A theory analysis is an objective comprehensive review of the strengths and weakness of a theory focusing on the usefulness, clarity, relevance and applicability of the theory to nursing practice. Walker and Avant (2011) propose a six-step process for theory analysis which includes: origins, meaning, logical adequacy, usefulness, generalizability or transferability, parsimony, and testability.

Determining the origin of the theory provides a glimpse into the viewpoint of the theorist by garnering an understanding of how and why the theory was established and determining if the approach was inductive or deductive. A theory is deductive if it was developed from another theory or hypothesis. In contrast, a theory is inductive if observations of relationships from data, literature, or clinical practice generated the theory. A review of the semantics and language used to describe the concepts and statements of the theory determines its meaning. Logical adequacy determines if the theory is clear and promotes an understanding of the relationships among components

and concepts and illustrates predictions arising from the theory. Oftentimes a diagram or model is used to visually depict the components and concepts and to generate predictions (Walker & Avant, 2011).

The usefulness of a theory determines the application to practice, by addressing the research studies conducted to support the application and clearing defining the problem it is serving to answer. The criterion of generalizability of the theory addresses its applicability to guide various practice settings as well as rigorous research studies. "A parsimonious theory explains a complex phenomenon simply and briefly without sacrificing the theory's content, structure, or completeness" (Walker & Avant, 2011, p. 205) and considers whether the components are precise and if they overlap. The validity and testability of a theory is determined by the ability of the theory to generate hypotheses which, in turn, builds a strong empirical evidence base; the stronger the evidence, the stronger the theory (Walker & Avant, 2011).

2.3.1 Mastery Learning Theory

2.3.1.a Overview. Mastery Learning Theory promotes an individualized teaching approach to support achievement of content taught. The propositions that constitute the foundation of mastery learning theory include: (1) clearly defined goals for achievement, (2) instructions that result in a level of proficiency, (3) a formative assessment followed by feedback that supports what was performed correctly as well as corrective tutorial to re-teach what was performed incorrectly, and (4) evaluation of performance (Guskey, 2007). Of critical importance is starting each activity with clearly defined goals also called instructional alignment (Guskey, 2005). Participants are taught evidenced-based content and given an initial formative assessment to obtain information on what the

student comprehended. This assessment provides the student with individualized performance feedback and can be conducted as a simple test or quiz, an oral question and answer exchange, a demonstration of a skill or a written essay. The content and teacher preference drives the format of the formative assessment inclusive of feedback that is both diagnostic and prescriptive complemented with corrective actions that serve to improve performance (Guskey, 2010). Evidence from the learner's performance helps the teacher determine what requires remediation. The teacher applies a variety of instructional approaches to then match these unique learning needs. Additional formative assessments are conducted each time a remediation occurs, continuously refining the corrective actions to match both the learner and the content that was retaught. This individualized approach to teaching improves the potential to achieve mastery (Guskey, 2005).

2.3.1.b Origins. Mastery Learning Theory, established and tested in the field of education (Bloom, 1968), is growing in popularity in healthcare education. "Mastery learning is an optimistic theory about teaching and learning," such that "any teacher can help virtually all students to learn" (Block, 1980, p. 66). It is a deductive-based theory in which the origin can be traced to the work of Carroll (1989) and Bloom (1986). With its origin developed in the field of education, Carroll developed a Model of School Learning that proposes a student will master content if given the amount of time necessary to learn at their own pace which is determined by the student's aptitude (Carroll, 1989). Both Carroll and Bloom contributed to the defining characteristics of this theory, but Bloom (1986) is credited as the author of Mastery Learning Theory. He built on earlier work done by Carroll (1963) who created the School Learning Model. Bloom (1968) published

the concept of Mastery Learning positing that with the exception of the 1-5 % of the truly gifted population, given the individual time necessary, a skill can be mastered by 90% or more of the students. The emphasis of Mastery Learning Theory is on the quality of instruction in addition to time allotted for each student (Carroll, 1989). Although this theory is not a nursing theory, it might be considered a situation-specific theory in that it focuses on the relationship between the concepts and makes a deductive prediction about the outcome (Meleis, 2007).

2.3.1.c Meaning. The major concepts in Mastery Learning are: mastery, time, aptitude, formative assessment and correctives. Mastery can be defined by the teacher by describing content as well as a summative evaluation with a predetermined set of criteria or score (Block, 1980). Mastery, as described by Bloom (1968), is determined when the student achieves the pre-established goals determined at the beginning of the instruction, which involve the elements of time and aptitude. Time spent on learning is a key factor in that all students need to not only learn at their own pace, but be provided ample time to achieve the expected learning outcome(s). The rate at which a student learns is a reflection of the learner's aptitude. This involves a set of group-based, individualized, teaching and learning strategies based on the premise that students will achieve a high level of understanding if they are given enough time. A formative assessment is a means to measure individual mastery (Bloom 1968). Guskey (2009) defined formative assessment as an evaluation of a student's performance within the context of pre-established learning outcomes often called success criteria. Finally, correctives are instructions provided by the teacher to remediate those components not mastered or achieved on a formative assessment (Guskey, 2007). In addition, Guskey (2007) further

explains that correctives are additional activities to teach those concepts not understood by the learner in a way that is different from previous teaching techniques.

2.3.1.d Logical Adequacy. Mastery Learning Theory follows a linear progression, as shown in Figure 2. Depiction of the Mastery Learning Process adapted from Guskey (2007) and Bloom (1968). The components of Mastery Learning Theory progress from goal setting to formative assessment and correctives or corrective actions and repeated teaching, as necessary, to reach the outcome of content mastery (Guskey, 2010). Carroll (1989) supported the application of Mastery Learning Theory along with its key elements of formative testing and corrective actions, yet shared a concern for its predictability for achievement. Guskey, (2007) reported that due to a misinterpretation of the key steps of Mastery Learning Theory, some educators delineated content into individual components and required mastery of one component before progressing to the next. Other educators expressed concern for the amount of time it would take to teach in this way. The structure and meaning of each component is clear yet the expected outcomes and predictions of this theory may vary depending on how teachers interpret and apply this theory to practice. The conclusions and predictions of this deductive theory are valid and in spite of a few concerns, it is deemed to possess logical adequacy (Walker & Avant, 2012).

2.3.1.e Usefulness. The medical education literature is replete in its use and demonstration of the efficacy of Mastery Learning Theory in clinical simulation. McGaghie, Issenberg, Barsuk and Wayne (2014) conducted a qualitative synthesis of 23 studies of Mastery Learning in the simulation-based medical education literature. Application of Mastery Learning has been shown to improve medical residents'

immediate performance in the simulated environment, which includes skills such as lumbar puncture (Barsuk et al., 2012), advanced cardiac life support (Wayne et al., 2006), temporary hemodialysis insertion (Barsuk et al., 2009), and paracentesis catheter insertion (Barsuk et al., 2012). In addition, healthcare related studies report that Mastery Learning has been shown to promote self-confidence and improve competence in clinical simulation learning experiences (Barsuk, McGaghie, Cohen, O'Leary & Wayne, 2009).

In contrast, only one study was found in the nursing education literature that tested Mastery Learning. Wu, Whang, Su, and Huang (2012) conducted an experimental study among 46 nursing students comparing traditional instruction to Mastery Learning in learning respiratory assessment skills. Wu and colleagues reported that those students who received Mastery Learning outperformed the control group on learning outcomes. Given the plethora of studies that have employed Mastery Learning in the medical education and the evidence that this approach improves confidence and competence of the learner, provides promise of its usefulness in nursing education. Using the three criteria by Walker and Avant (2012) of a theory's usefulness (amount of research, ability to address a variety of clinical problems, potential to influence education) Mastery Learning within the medical literature is a useful theory; however its usefulness in nursing education is unknown but potentially relevant to the discipline.

2.3.1.f Generalizability. Wise and Vardi (2005) conducted a quasi-experimental study applying Mastery Learning Theory to teach safe patient handling skills to 156 occupational therapy students. In the control group, the test score average was 63%, as compared to 100% for the intervention group. In an open-ended questionnaire, the study

group reported a strong preference for feedback and assessment and that the Mastery Learning approach made them feel "relaxed" and better prepared (Wise & Vardi, 2005)

Wayne and colleagues (2006) used a one group, quasi-experimental design and tested how well internal medicine residents (N = 41) could master the skills required to perform the American Heart Association (AHA) program for Advanced Cardiac Life Support (ACLS) in a simulated environment applying mastery learning in the teaching process. The majority (80.5%) of the residents achieved mastery without corrective action, while 19.5% required corrective actions ranging from 15 to 60 minutes of additional instruction. All participants reported improved competence and self-confidence, and agreed "that practice with the simulator should be a required component of residency education, and that the medical simulator prepared them to be a code leader better than the AHA ACLS provider course" (p. 254) yet this does not replace direct patient care experience. Wayne et al. (2006) recommended that the application of mastery learning requires further investigation but has the potential to influence performance of the healthcare provider.

Butter, McGaghie, Cohen, Kaye, and Wayne (2010) conducted a quasi-experimental study among medical students to test the hypothesis that the use of simulation technology to teach cardiac auscultation using Mastery Learning is more effective in achieving competence than traditional clinical experience alone. A group of 77 third year medical students received the intervention, simulation and mastery learning, and were compared to a control group of 31 fourth year medical students. No significant difference in pretest scores were found between groups: however, third year students achieved higher post-test scores ($p < 0.001$). Third-year (simulation-trained) students also

showed improved accuracy when examining actual patients when compared to untrained fourth-year students ($p = 0.003$) (Butter et al., 2010). Butter and colleagues concluded that a competency-based approach to educating medical students was both feasible and practical and had a positive impact on patient care and patient outcomes.

Barsuk, McGaghie, Cohen, O'Leary, and Wayne (2009), conducted a year-long observational cohort study to assess 103 internal medical residents skill for inserting a central venous catheter. A total of 27 residents received traditional education and 76 received simulation and Mastery Learning as a teaching approach. The intervention had a significant effect on the overall insertion success rate ($p = 0.005$) and a positive impact on some but not all of the individual quality indicators such as the number of needle passes and complications from the catheter insertion. This study posits that simulation-based mastery learning and deliberate practice impact competence (Barsuk, et al., 2009).

In a recent study conducted by Wu, Hwang, Su and Huang (2012), the teaching strategy of simulation based mastery learning was compared to traditional instruction among a sample of 46 Taiwanese undergraduate nursing students. The experimental group ($n = 22$) was provided a 180 minute interactive computer based simulated experience on respiratory assessment which provided immediate feedback on clinical performance and the opportunity to practice until mastery was achieved. The control group ($n = 24$) received 180 minutes of traditional instruction that discussed patient information (Wu, et al., 2012). Posttest scores and the skills test of the experimental group were significantly better than the control ($p = 0.00$ and $p = 0.02$) respectively confirming mastery learning as more effective than a traditional approach (Wu, Hwang, Su, & Huang, 2012).

A study conducted by Scholtz, Monachino, Nishisaki, Nadkarni, and Lengetti (2013) examined the effectiveness of using "just in time" and "just in place simulation training" on the performance of central venous catheter dressing changes to 524 inpatient nurses in a large teaching pediatric hospital in the US. A post-hoc review of the literature highlighted that Mastery Learning Theory paralleled the teaching approach applied in this study. A train to excellence approach, defined by zero prompts to complete the skill correctly, was used and was consistent with some of the principles of mastery learning. A pre and posttest was used to assess competence and confidence with a significant improvement in confidence for the procedural skill ($p < 0.0001$) and competence ($p < 0.0001$) for preforming the skill both simulated and on the patient. Nurses who participated in this educational intervention required fewer prompts, using a reference tool created from the procedure, to complete the same skill on a patient ($p <0.001$) which resulted in a decrease in central line associated blood stream infection from 5.3/1000 to 2.9/1000 line days ($p <0.001$) and 173 fewer patients acquiring infections (Scholtz, Monachino, Nishisaki, Nadkarni & Lengetti, 2013).

Walker and Avant (2012) state that if the research testing the theory is rigorous, has validity, uses adequate sample size derived from diverse populations and the evidence from these studies is reproducible, the theory will be generalizable. The literature cited above adequately meets these criteria with the exception of using diverse populations of learners. The vast majority of the studies were conducted on medical residents/students therefore further testing could be beneficial if tested on learners within the field of nursing.

2.3.1.g Parsimony. Mastery Learning Theory mandates instructional goals that are clearly linked and align with the content to be taught. Formative assessments are employed and are based on the subject matter taught and the instructional goals. The result of each student's formative assessment then determines the corrective actions serving as a remediation. The individual instruction provided to each student matches the learning needs identified by the assessment. This repetition of formative assessment and corrective activities serve as the way to measure what the student learned and what requires further remediation. Overall, this theory simplifies a complex process for teaching using four clearly stated components: (1) distinctly defined goals, (2) instruction/teaching, (3) formative assessment and corrective action, and (4) evaluation of performance (Guskey, 2007). These constructs progress without overlap and therefore the theory is considered parsimonious (Walker & Avant, 2012).

2.3.1.h Testability. The outcomes of the studies by Wise and Vardi (2005), Wayne et al., (2006), Butter et al. (2010), Barsuk, et al. (2009), Wu et al. (2012), and Scholtz, et al. (2013) all reported that the intervention group, those who received Mastery Learning, outperformed the control group who did not receive instruction using mastery learning principles. The empirical evidence of the studies referenced above is strong and therefore the hypotheses generated provided evidenced of the theory's testability (Walker & Avant, 2011).

2.3.2 Self-Regulation Learning Theory

2.3.2.a Overview. Self-regulation is a reflection of the relationship between the individual, the environment, such as creating a quiet study space, and the individual's behavior. "Self-regulated learning occurs to the degree that a student can use personal

processes to strategically regulate behavior and the immediate environment" (Zimmerman, 1995, p. 330). Self-regulation strategies are actions taken by the learner to obtain information that helps the learner take action to improve performance. Strategies may be as simple as seeking and organizing information or as complex as rehearsal, self-monitoring and self-assessing, or seeking assistance from others (Zimmerman & Pons, 1986).

2.3.2.b Origins. Schunk and Zimmerman (1997) state that self-regulation was developed from a social cognitive perspective. With its roots in social cognitive theory, there are two constructs reported: social modeling and self-efficacy. Social modeling is described as observed behaviors, beliefs or thoughts that influence a student's ability to achieve academic success, "which creates a sense of self-efficacy for academic self-regulation and motivates students to engage in these activities" (p. 197). Self-efficacy is individuals' belief that they can perform the behaviors needed in order to produce certain outcomes for specific tasks (Bandura, 1985). This modeling behavior begins by imitating the actions of others which promote academic success and progresses to a more mature, internally driven approach preparing the student to manage more complex learning activities and concepts. This progression needs to match the maturation of the student in that skipping this step can result in ineffective self-regulation (Schunk & Zimmerman, 1997). Modeling behaviors can be demonstrated by other students/peers, parents or teachers (Zimmerman, 2002).

Zimmerman describes Self-Regulation Theory as an advancement of social cognitive theory and ascribes that while influenced by social cognitive theory, Self-Regulation Theory is a cyclic relationship between planning, practicing and evaluating

personal learning (retrieved from: http://learningandtheadolescentmind.org/people_04.html). The self-regulated learner has a keen understanding of what strategies work best (Zimmerman, 1989). These statements and predictions about the outcomes of self-regulation learning theory were derived from a social cognitive theory and are therefore considered deductive in origin (Walker & Avant, 2012).

2.3.2.c Meaning. Self-Regulation Theory is defined by three distinct yet interrelated phases: forethought, performance and self-reflection (Zimmerman, 2002). Collectively, these actions serve as a foundation to predict success for present and future learning practices. Each phase also has sub phases that comprise the actions necessary for success. Forethought, the planning stage of this three-phase approach, encourages the learner to assess and define the learning challenge by looking at both current information and past experiences (retrieved from: http://learningandtheadolescentmind.org/people_04.html). Forethought, inclusive of goal setting and strategic planning, initiate the steps toward achievement and are exemplified by actions "…such as memorizing a word list for a spelling test" (Zimmerman, 2002, p. 68).

Self-control and self-observation make up the performance phase. Exhibiting behaviors of self-control, the learner executes specific activities identified during the forethought phase and may include such things as imagery to remember a word when studying another language. Self-observation promotes learning by comparing, for example, two approaches to learning a concept and then determining which was most effective or successful in achieving the expected outcomes (Zimmerman, 2002). This

phase is also called the practice phase whereby the student adjusts their plan after self-evaluation of their progress (retrieved from: http://learningandtheadolescentmind.org/people_04.html).

The third and final phase, self-reflection, consists of self-reaction and self-judgment whereby the learner compares their personal outcomes with either personal or standardized outcome measures. Attaching an emotion to this personal accomplishment is a common example of self-reflection (Zimmerman, 2002). After completing a personal assessment of goal attainment, the outcome(s) may sometimes result in the initiation of another cycle beginning with a new forethought phase (retrieved from: http://learningandtheadolescentmind.org/people_04.html).

2.3.2.d Logical Adequacy. The cyclic process of Self-Regulation, as shown in Figure 3. Depiction of Self-Regulation Process adapted from Zimmerman (2002) and Dunn et al. (2012), engages more than detailed knowledge of a skill; it also assumes that the individual is self-aware, self-motivated (Zimmerman, 1989) and behaviors are proactively planned and deployed to promote learning. It is through self-awareness that learning goals are set and evaluation of goal attainment is completed (Zimmerman, 2002). Cleary and Zimmerman (2000) found that non-experts self-correct differently than experts. This difference is because self-regulation is not simply a trait that individuals either possess or lack, but an attribute that involves selective use of specific processes that must be personally adapted to each learned task and that results in increased competence with the self-regulatory process as the individual becomes more sophisticated in the application of the process (Schunk & Zimmerman, 1994; 1998). For example, novices may skip the forethought phase and jump to self-regulatory actions

without consideration of goal setting and strategic planning. The expert, on the other hand, often exhibits self-control and discipline for planning goals, defining outcomes and performing a self-evaluation (Zimmerman, 2002).

The structure and meaning of each phase of this cyclic process is clear and the expected outcomes and predictions are consistent. Although there are some inconsistencies for the names of each phase, the conclusions and predictions this deductive theory ascribes to are valid and it is therefore deemed to possess logical adequacy (Walker & Avant, 2012).

2.3.2.e Usefulness. Self-Regulation Theory has applicability and usefulness in the classroom as well as a professional environment (Zimmerman, 1998). Effective self-regulation strategies are lifelong skills transferable to any setting. Practicing individual learning strategies, social modeling and learning from others can enhance skill development and promote proficiencies for a new job or new responsibilities (Zimmerman, 2002) confirming its usefulness beyond the classroom.

2.3.2.f Generalizability. Much of the research on Self-Regulation has been conducted on students ranging from middle school to graduate school or those students who are classified as "at risk". Regardless of the level of the student, the findings are consistent and support that student academic success occurs when self-regulation strategies are employed (DiBenedetto, 2011). Dunn, Osborne and Link (2012) conducted research on the performance and self-reflection phases of the self-regulation process. The primary purpose of the study was to determine the fundamental elements, termed causal attributes, which influenced the students' self-regulation behaviors. Seventy-two undergraduate nursing students enrolled in a pathophysiology course and completed the

General Strategies for Learning subscale of the Motivated Strategies for Learning Questionnaire to assess each student's propensity for self-regulated learning. Collectively, Dunn et al., (2012) defined causal attributes as luck, ability and effort with ability having the greatest effect on self-regulation. The final results concluded that "students' causal thinking does affect the degree to which they regulate learning activities" (p. 355).

In a qualitative study of 32 associate and bachelors prepared graduate nurses, Kuiper (2002) reported that reflective and repetitive journaling was an effective method of self-regulation, which impacted clinical reasoning, and facilitated the transition phase from student to practicing nurse. During an 8-week precepted orientation, journaling was taught as a self-regulated learning strategy in an effort to improve self-efficacy and knowledge (metacognition). For the novice nurse, the use of self-regulation strategies, specifically journaling, promoted clinical competence and expertise (Kuiper, 2002)

Sharples and Moseley (2011) conducted a non-experimental design study with two cohorts of first year student nurses at Thames Valley University in the United Kingdom to assess their use of self-regulation skills when working in a patient care environment. The initial cohort (n = 47) completed a 35-day program consisting of a blend of self-directed, instructional (tutorial) and direct patient care (attachment) days. Overall the program was evaluated positively by 64% of the students with a particular interest in the attachment days and reported that the self-directed/self-regulated days were less useful. Based on the feedback from the initial cohort, the second cohort (n = 54) participated in a revision of the 35-day program which had less self-directed days, less attachment days and more tutorial days. The belief in the importance of self-directed

learning activities remained constant in spite of the reduction in time allotted for this type of learning. After the program changes were implemented for the second cohort, the same program evaluation was completed. Of concern to the investigators was "the percentage of students who felt the self-directed days had no value increased slightly" (p. 348) with rates of 23% to 28% for the first cohort to second cohort respectively. The research team concluded that providing new students instructions for self-regulated learning strategies may increase its perceived value (Sharples & Moseley, 2011).

The research studies reported by Dunn, et al. (2012), Kuiper (2002), and Sharples and Moseley (2011) are testaments of the application of self-regulation across cultures. Kuiper (2002) states that “self-regulation strategies are needed for all levels of practice” (p. 86) supporting the need for further assessment of this theory’s applicability to nursing education.

2.3.2.g Parsimony. The key elements of the theory of Self-Regulated learning are consistently referenced as planning to learn, practicing the content taught and evaluating the outcome(s) (retrieved from: http://learningandtheadolescentmind.org/people_04.html) yet the constructs are often labeled differently. Zimmerman (2002) and Dunn et al (2012) use the terms, forethought, performance and self-reflection to describe the three phases of self-regulated learning. In general, “Self-regulation can be defined as self-generated thoughts, feelings, and actions for attaining academic goals” (Zimmerman, 1998). Although authors may vary in the terms used to define each step in this theory, the theory describes the cyclic process students will employee to master content in a way that is simply stated without overlap and is therefore considered parsimonious (Walker & Avant, 2012).

2.3.2.h Testability. Comprehensive research on Self-Regulation Theory, in the field of education, has led to a growing interest for how best to measure the application of key elements in the learning environment (DiBenedetto, 2011). The key elements have not been modified as a result of testing and research. Also, the hypothesis for the effectiveness of the theory in practice has remained constant and continues to support interest in the application and measurement of self-regulation (Walker & Avant, 2011).

2.4 Discussion

Based on the analysis of Mastery Learning Theory and Self-Regulation Theory, the evidence supports their usefulness and applicability to nursing education practices. This application may support an effective teaching approach that promotes the QSEN imperatives of knowledge, skill and attitude (KSA) (Cronenwett, et al., 2007). The multiple research studies on Mastery Learning Theory in medical education report its ability to improve competence and confidence of the learner aligning with basic competency requirements for all healthcare professionals (Disch, 2012). Adhering to the fundamental concepts of repeated instruction followed by assessment and remediation (Guskey, 2005), Mastery Learning fosters the learner's ability to achieve expertise (Zimmerman, 2002).

In addition, the elements of self-regulation are agreed upon by education experts yet "researchers have been faced with the challenge of developing accurate ways to measure self-regulation learning and the various processes that individuals engage in when learning a task" (DiBenedetto, 2011, p. 1). "The motivation of novices can be greatly enhanced when and if they use high-quality self-regulatory processes…" (Zimmerman, 2002, p. 66). Promoting and developing effective self-regulation behaviors

that nurses can apply when caring for patients may enhance competence and confidence and improve patient outcomes.

2.5 Conclusion

Applying Mastery Learning Theory in nursing education may have a significant impact on nurses' use of self-regulation strategies that could result in improved patient care and patient outcomes. Zimmerman (1989) purported that manipulation of the learning environment or approach will impact the student's ability to apply self-regulated learning strategies and influence their self-efficacy or personal beliefs about learning potential (Zimmerman, 1989). "Innovation focused on how new knowledge is rapidly and reliably incorporated into routine practice and aligned across all levels of the health care system is an urgent priority" (Dougherty & Conway, 2011, p. 2319). Yet, evidence of the applicability of the use of Mastery Learning as an instructional approach and the influence on Self-Regulation is scant. Conducting and translating educational research on the application of a teaching strategy, mastery learning, and its influence on self-regulating practices might serve as a foundation for how we teach nursing practice and may impact both the confidence and the competence of the nurse (Translation 1). Drawing a correlation of applying this theory to nursing education and the impact on quality care has profound potential for impacting patient outcomes (Translation 2). The end result could be the creation of a standard for how nurses are educated (Translation 3) on key nursing actions in an effort to impact patient care and clinical outcomes (Dougherty & Conway, 2008). The translation of this type of research and quality improvement initiatives to patient care is an imperative in today's healthcare environment.

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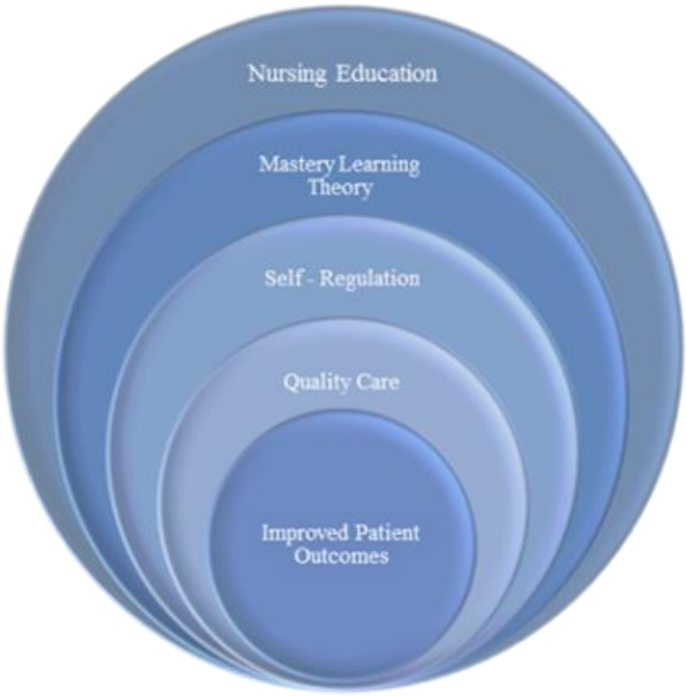
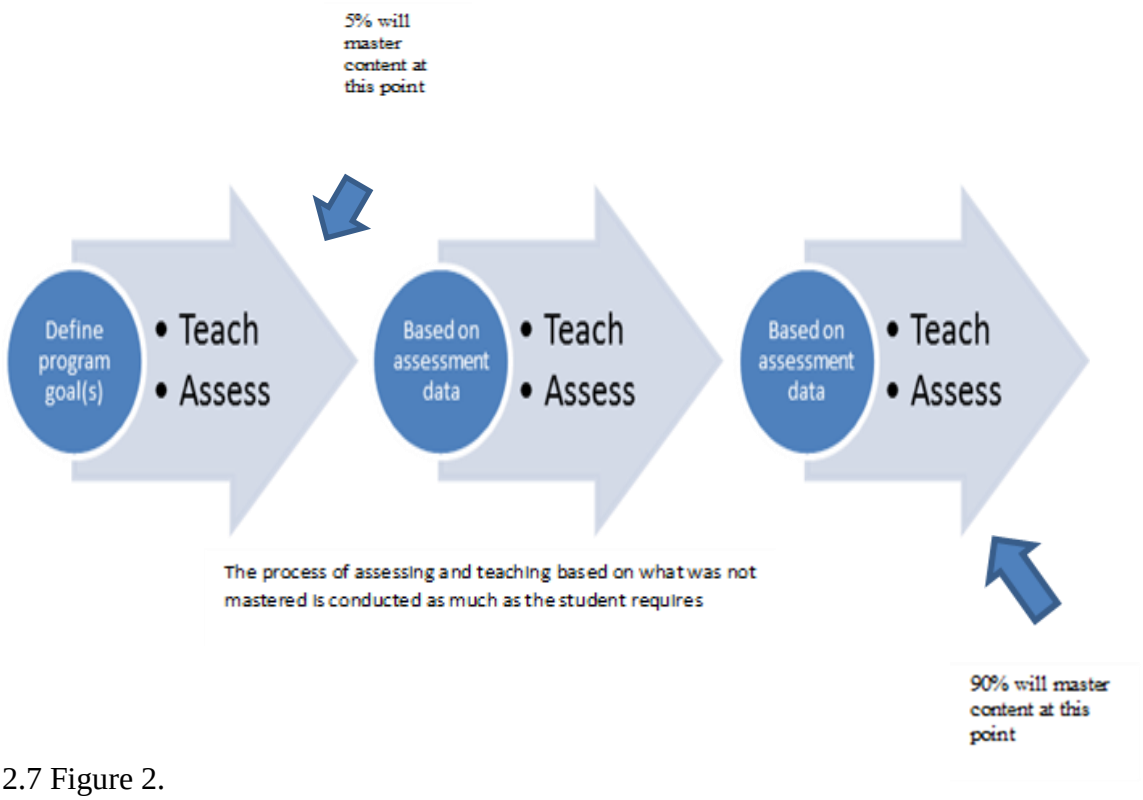
2.6 Figure 1

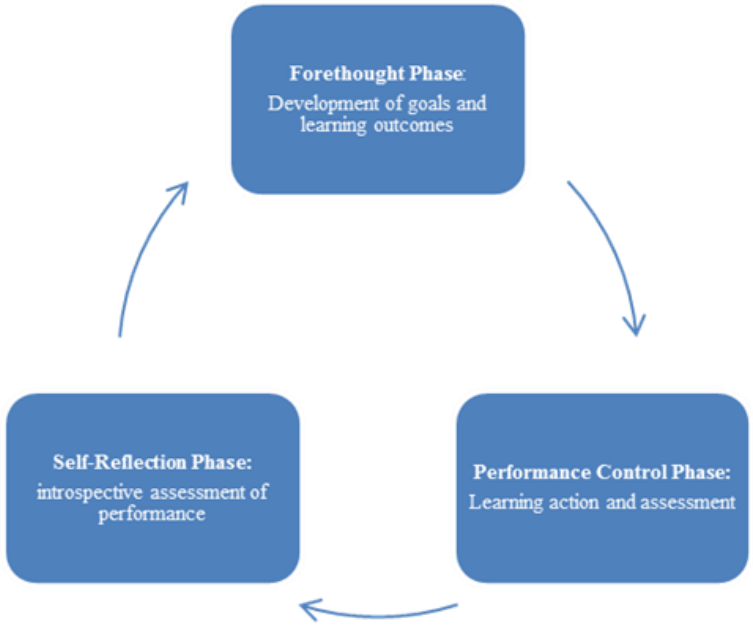


The Integration of Nursing Education, Mastery Learning Theory, Self-Regulation, Quality Care and Improved Patient Outcomes



2.7 Figure 2.

Depiction of the Mastery Learning Process



2.8 Figure 3.

Depiction of Self-Regulation Process

Chapter 3

3.0 RESEARCH METHODOLOGY AND FINDINGS

Manuscript #2

RANDOMIZED CONTROLLED TRIAL ASSESSING THE IMPACT OF AN INNOVATIVE APPROACH TO EDUCATING NURSES TO CLINICAL COMPETENCE

Formatted for publication

3.1 Abstract

Aim: This study examined the effect of mastery learning on nurse residents' skill and self-regulation practices for indwelling urinary catheter insertion in a simulated learning environment.

Background: Today's dynamic healthcare environment demands that educators investigate the effectiveness of current teaching strategies on nursing clinically competence. Clinical competence is a patient safety imperative and it is therefore imperative to test the most effective and efficient ways to educate competent nurses resulting in improved safe patient care and clinical outcomes.

Method: This longitudinal quantitative study examined performance of insertion of a urinary catheter initially and at one-month post intervention and the self-regulation practices of all participants.

Results: There was no significant change in mean scores within or between groups. The experimental group scored higher on those procedural steps deemed critical. The experimental group had a significantly higher mean Survey of Academic Self-Regulation score.

Conclusion: Retention of the critical steps is valuable because if performed incorrectly, these steps will cause harm to the patient. Self-regulation practices promote an intrinsic motivation to acquire and maintain new knowledge**.**

3.2 Introduction

The complexity of today's healthcare environment necessitates the exploration of how nurses are taught to provide clinically competent patient care. Watson, Stimpson, Topping, and Porock (2002) reported that "One of the major difficulties with clinical competence assessment is the definition of the term 'competence" (p 422) often used synonymously with words such as performance and capability. Eraut (1998) defined competence as the skills required to perform job related duties and responsibilities. It is reported that nursing skills and knowledge, which are influenced by academic preparation and continuing education, directly impact patient outcomes and organizational performance (Covell, 2008). Clinical experience alone does not assure competent practice because it lacks some crucial instructional components such as review of individual performance goals, guided practice, and feedback on patient care (McGaghie, 2015a). A determination of what competence is and how it is measured is not only a nursing concern but a patient safety imperative (Bradshaw, 1997); therefore, it is vital to invest in research to identify the most effective and efficient ways to educate nurses (Covell, 2008).

The purpose of this longitudinal quantitative experimental research study was to test the effect of mastery learning compared to traditional learning on new to practice nurses' skills and self-regulation habits when inserting an indwelling urinary catheter. Catheter associated Urinary Tract Infections (CaUTI) are a significant patient safety

challenge and concern for healthcare providers accounting for 30 % of all Hospital-Acquired Conditions (HAC) annually and are partly related to the initial insertion of the catheter (Centers for Disease Control and Prevention. Healthcare Infection Control Practices Advisory Committee (HICPAC) retrieved from: http://www.cdc.gov/hicpac/CAUTI_fastFacts.html). Considered preventable by the Centers for Medicare & Medicaid Services (CMS), hospitals will receive no additional financial reimbursement for patients with this HAC (Institute for Healthcare Improvement (2010). Retrieved from http://www.ihi.org/topics/CAUTI/Pages/default.aspx). One CaUTI can cost as much as $758 per infection (Anderson et al., 2007). The application of these research findings will provide new evidence about the effectiveness of applying Mastery Learning as an approach to educating nurses, with the potential of improving clinical performance which impacts overall care provided therefore minimizing costly adverse hospital acquired conditions.

3.3 Background

For the purposes of this study, traditional learning was defined as an instructor lead program that focuses on content and memorizing key concepts (Guskey, 2010) with a single summative assessment at the end of a learning session (Iwasiw, Goldenberg & Andrusyszyn, 2009). In contrast, Mastery Learning is considered a competency-based teaching strategy (Roberts, Ingram, Flack, & Jones Hayes, 2013; Tang & Dong, 2013) promoting the best learning conditions which allow the individual student enough time to meet the desired learning outcome (Guskey & Anderman, 2013). Individual achievement is measured by evaluating performance against a preset standard and a clear measurement

of what mastery looks like (Bloom, 1968). Although additional time may be required (Roberts, Ingram, Flack, & Hayes, 2013), this instructional flexibility allows the student to learn at their own pace, and promotes an individual approach to teaching (Bergmann & Sams, 2013).

The differentiating component of mastery learning compared to a traditional approach is the complement of feedback (based on formative assessment) and corrective actions (correctives). Formative assessments can consist of anything a teachers does to gather information about a student's performance and understanding of content taught (Guskey, 2010). Correctives can be defined as "explicit, targeted suggestions" (Guskey, 2010, p. 53) that provide students with the information they need to achieve mastery of the content taught. Providing both feedback and correctives throughout the instructional process allows the teacher to identify the content not mastered and then promote tailored instruction to satisfy that learning gap (Guskey & Jung, 2011). Rather than employing a single summative assessment at the conclusion of a lesson, mastery learning promotes frequent formative assessments coupled with correctives. This repetitive cycle of formative assessments, feedback and correctives validates what the student has learned and promotes confidence and motivation (Guskey, 2010). Block (1980) describes this as "the single most important component of the mastery learning strategy" (p, 67) in that individualized targeted instruction allows the learner to review content not yet mastered.

Self-regulation is defined as the personal tactics a learner employs to prepare for a learning activity and includes the self-awareness, self-motivation, and behavioral skills essential to achieve knowledge acquisition (Zimmerman, 1989). Examples of tactics used to learn new knowledge can include seeking and organizing information, practicing, self-

monitoring and self-assessing, or getting help from others (Zimmerman & Pons, 1986). Self-regulation is not another form of learning, it is a practice that the student exercises as a way of self-motivating to achieve personal learning goals (Boekaerts & Cascallar, 2006). The three phases of this cyclic process starts with the learner setting personal goals and expected learning outcomes. This phase is called forethought. The second phase, performance control, reflects the actions needed to meet the desired learning goals, followed by an assessment of the ability to accomplish them and a check on personal performance. The final phase, self-reflection, is an introspective assessment of performance evaluated against the expected goals and outcomes. While the last phase evaluates performance against the initial learning goals set during forethought, the student's judgment and reactions to the personal achievement may force the learner to cycle back to the beginning initiating another sequence starting with revised forethought and goal(s) (Cleary & Zimmerman, 2004), (Dunn, Osborne, & Link, 2012). Self-reflection is essential for future learning activities in that how the student judges the performance provides helpful feedback to be used during the forethought phase of future learning (DiBenedetto & Zimmerman, 2013).

3.4 Methods

3.4.1 Sample/Setting

This study was conducted from May 2015 to April 2016. All participants had a Bachelor of Science Degree in Nursing (BSN) and were active participants in a Nurse Residency Program (NRP). Inclusion criterion included any staff nurse who was a current member of the NRP and did not have prior experience as a practicing registered nurse.

3.4.2 Recruitment

All potential participants were asked to participate in this study by the Principal Investigator (PI) during the initial Nurse Residency Seminar conducted at the start of their employment using a standard script describing the details of the study, risk and benefits to the participant and how all information was managed to ensure confidentiality and privacy of all personal information. This study was approved by the Institutional Review Boards for Duquesne University and the study site**.**

This longitudinal randomized controlled trial was conducted in a large acute care health system. Nurse Residents, were randomized into either the experimental group (mastery learning) or the control group (traditional learning). Both groups were asked to complete a self-paced computerized instructional module that reviewed the procedural steps for the insertion of an indwelling urinary catheter in a female prior to the initial assessment. This module took approximately 10-15 minutes to complete.

The initial competency assessment for both groups was conducted within two weeks of employment at the institution's simulation center. All participants were asked to perform the procedure for insertion of an indwelling urinary catheter. Four nurse experts, who were Master's Degree prepared and served as coordinators for the nurse residency program (NRP) were assigned to this study and monitored each study participant's initial assessment as well as the reassessment conducted one month later. The experimental group was permitted multiple attempts with feedback and correctives for each step performed incorrectly. The control group received one attempt with performance feedback at the end. One month after the initial assessment, the skill was reassessed by one of the expert nurses with feedback provided at the end of the session. In addition, The

Survey of Academic Self-Regulation (SASR), was administrated to all study participants at the one-month assessment.

3.4.3 Instruments

3.4.3.a Performance Assessment Tool (PAT). The Performance Assessment Tool (PAT) (Appendix A) is a procedural checklist developed directly from the procedure manual used by the institution where the study was conducted. This 65 step procedure was used at the initial and one-month assessment for both groups to measure each participant's ability to insert an indwelling urinary catheter in a female. The PAT is a criterion-based assessment tool in that it measures the individual's performance against a practice standard (Waltz, Strickland & Lenz, 2010). A higher score indicates a greater number of procedural steps performed correctly.

Construct validity of the PAT was established at the start of the study. The content of the PAT was evidenced-based and measured what was intended, matching every step of the procedure. All expert nurses completed this skill using the PAT which assured their individual competence and verified that the task was "doable" and "fair" for all participants to accomplish and master. To verify consistency among all expert nurses, confirm data integrity and minimize the potential for recording error, a thorough review of the information recorded on the PAT was completed at the end of each assessment by the PI (Downing, 2003).

3.4.3.b Survey of Academic Self-Regulation (SASR) Questionnaire. The Survey of Academic Self-Regulation (SASR) (Appendix B) is a 63 item self-report questionnaire which measured the participants' report of self-regulation practices on a six-point Likert scale: Strongly Agree (6) to Strongly Disagree (1). It is organized into

six subscales: (1) metacognition (contemplating or thinking), (2) extrinsic motivation (external rewards), (3) self-regulation (study habits), (4) personal relevance & control (personal expectations), (5) intrinsic motivation (personal mastery), and (6) self-efficacy (personal beliefs). This questionnaire was developed, pilot tested and retested on a sample of college students. The researcher applied standard construct validity procedures which produced an overall alpha of 0.92 (Dugan & Andrade, 2011). The SASR tool was modified, with permission from the author, to fit this study population of nurses. Reliability of the overall score was assessed after the completion of the study by calculating a coefficient alpha.

3.4.4 Data Collection

3.4.4.a Initial Assessment. The control group (traditional learning) completed the nursing procedure for insertion of an indwelling urinary catheter on a female task simulator one time only. The skill was assessed by an expert nurse using a dichotomous scoring scale of 0 (did not perform correctly) and 1 (did perform correctly) and individual performance was documented on the 65 step PAT. Feedback about performance was provided at the end of the assessment and any actions completed incorrectly were discussed. The PAT is considered a summative assessment for this group because it is a single assessment which measured the participant's understanding of the content taught in the self-paced computerized instructional learning module (Iwasiw, Goldenberg & Andrusyszyn, 2009). The average time for this learning activity was 15 minutes with a *SD* = 4.36.

The experimental group (mastery learning) completed the nursing procedure for insertion of an indwelling urinary catheter on a female task simulator. The skill was

assessed by an expert nurse using a dichotomous scoring scale of 0 (did not perform correctly) and 1 (did perform correctly) and individual performance was documented on the 65 step PAT. Based on evidence, there were 17 of the 65 steps of this procedure that the PI and Expert Nurses deemed critical. These steps were defined as critical because, if performed incorrectly, they would cause harm to the patient. Quality improvement data and antidotal patient outcomes, for example, are sources of evidence used to determine critical steps (Yudkowsky, Park, Lineberry, Knox, & Ritter, 2015). If a performance error occurred at one of these critical steps, the participant was asked to stop and the nurse expert provided immediate feedback on the step performed incorrectly. The participant was given corrective action(s) and then asked to perform the entire procedure again starting at the beginning. This process continued until all seventeen critical steps were completed correctly without any prompts from the nurse expert. The average number of attempts was 2.43 (SD = 1.334) with a range of one to six attempts. Feedback and remediation was provided for the non-critical steps also but the participant was not required to start over again. The PAT is considered a formative assessment for this group because it provided information for the nurse expert to measure the participant's performance and determine their understanding of content taught in the instructional learning module so that both feedback and corrective actions could be provided (Guskey, 2010). The total time for this learning activity averaged 25.7 minutes with a *SD* = 11.58.

3.4.4.b One Month Post Initial Assessment. Based on the outcomes of the research study conducted by Sutton et al. (2011) whereby a degradation of skill retention was noted at a one-month post intervention assessment, all participants were asked to complete the skill of insertion of an indwelling urinary catheter on a task simulator one

month post intervention. Most often, this assessment was conducted in a location away from direct patient care areas. Some nurses chose to attend this one-month assessment on a day off from work while others took a break from their patient care assignment to compete the assessment. The skill was assessed by an expert nurse using a dichotomous scoring scale of 0 (did not perform correctly) and 1 (did perform correctly) and individual performance was documented on the 65 step PAT. For this assessment, the PAT is considered a summative assessment because it is a single measure of each participant's ability to perform the steps of this procedure (Iwasiw, Goldenberg & Andrusyszyn, 2009). Feedback about performance was provided at the end of the assessment and any actions completed incorrectly (required prompting) were discussed. The average time for this assessment activity was 10.46 minutes with a *SD* = 2.29. Additional data was captured at this time to assess how many indwelling urinary catheters each participant inserted since the initial assessment as well as the clinical unit they worked on the most during that same time period.

3.4.4.c SASR Questionnaire. The SASR pen and paper self-report questionnaire was administrated to all study participants at the one month reassessment in a quiet private setting not located near any patient care areas. Participants were asked to read and honestly answer each question using a six-point Likert scale. The total time to complete this tool was an average of 7.14 minutes with a *SD* = 1.99. The data collection process can be found in Table 1.

3.4.5 Statistical Analysis

Descriptive statistics for sample demographics are provided in Table 2. Group statistics were generated to calculate the mean, standard deviation and standard error

mean for each test as well as the Levene's test for equality of variance (*F* statistic). Unless otherwise indicated, a *p* value of less than 0.05 indicated a statistically significant finding. SPSS version 22 (SPSS, Inc., Chicago, IL, USA) was used for all calculations.

Initially, a dependent-groups or paired *t*-test was conducted for both the experimental and control groups separately to determine if there was a significant difference between the average change in scores within groups measured initially and one-month post intervention. A subsequent independent samples *t*-test was conducted to determine the difference between the average change in initial and one-month post intervention scores between the control and experimental groups. An independent groups *t*-test was conducted to determine differences between SASR scores of the control and experimental groups.

3.5 Results

3.5.1 Performance Assessment Tool (PAT)

Via a power analysis, a sample size of 40 participants was determined to be adequate to test the study's hypothesis. The initial sample included 42 graduate nurses who were randomized to either the control (traditional learning) or experimental (mastery learning) group. Three participants were lost to follow-up resulting in 19 study participant in the experimental group and 20 in the control group for an analytic sample of 39. The mean score on the PAT for the control group increased from initial (M = 46.55, SD = 8.575) to one-month post intervention (M = 50.65, SD = 9.516). The mean score on the PAT for the experimental group decreased from initial (M = 55.26, SD = 7.571) to one-month post intervention (M = 52.32, SD = 7.499). Although the experimental group had lower one-month post intervention scores compared to the initial

score, the mean change within groups was not significant, control group, $p = .128$ and experimental group, $p = .275$. A comparison of initial vs one-month mean and standard deviation for PAT scores can be found in Table 3.

Between group statistics for the mean change in initial and one-month post intervention scores for both the control ($M = 4.10$, $SD = 11.53$) and the experimental ($M = -2.95$, SD 11.40) groups indicate that the experimental had a lower mean change in scores indicating that their PAT scores had less fluctuation. The difference in the mean change in score between groups one-month post intervention was not significant, $p = .063$. A comparison of initial vs one-month mean change in PAT scores can be found in Table 4.

An additional independent samples *t*-test was conducted to evaluate the mean difference for the initial and one-month post intervention scores between the control and experimental groups for just the seventeen critical steps. This test was significant, $p = .013$. The experimental group's mean score was higher ($M = 14.58$, $SD = 1.26$) then the control group ($M = 13.85$, $SD = 2.11$) indicating the retention of these steps was significantly greater in the experimental group as compared to the control.

3.5.2 Survey of Academic Self-Regulation (SASR) Questionnaire

The group statistics for the total score for the control vs experimental SASR questionnaire was generated. The mean for the experimental group ($M = 308.58$, $SD = 15.09$) is greater than the mean for the control group ($M = 292.70$, $SD = 28.05$) indicating that the experimental group reported using learning and study strategies more often than the control. This difference in mean score was significant, $p = 0.035$. In addition, the

alpha coefficient for the 63 items is 0.909 confirming that the items have relatively high internal consistency.

Analysis of the SASR subscale Metacognition (MC) which reflects contemplation on goal setting, tracking and evaluating progress, and altering performance goals as necessary (Dugan & Andrade, 2011) was completed. The mean MC subscale score for the experimental group (M = 93.10, SD = 6.77) was greater than the mean for the control group (M = 85.65, SD = 10.89). The mean MC subscale scores for the control and experimental groups are significantly different with, p = 0.042. There were no other significant differences in the other five sub-scale scores.

Further review of the SASR data that analyzed each individual question in the MC subscale, highlighted the statements "I know when and where to use certain learning/studying strategies" and "When learning is boring I find ways to make it interesting" was significant, p = .008 and p = .000 respectively.

3.6 Discussion and Implications

Although when comparing the difference in PAT initial scores to one-month post intervention scores both within and between groups were not significant, we cannot forego the need to continue to test and explore teaching strategies that promote clinical competence. Of importance is the retention of the seventeen critical steps retained by the experimental group. The retention of these steps was significantly greater in the experimental group as compared to the control. This finding is important because, if performed incorrectly, these steps will cause harm to the patient. Completing these steps correctly is imperative especially when nursing care is focused on patient safety, clinical outcomes and minimizing CaUTI.

Of note, determining if inserting an indwelling catheter on an actual patient between assessments had a significant impact on the one-month assessment scores was also evaluated. A total of eight participants reported having placed an indwelling catheter in a patient during this time frame and upon analysis, this was not significant. An exploration of the impact of clinical unit and skill retention at one month was also conducted and the type of clinical unit each participant worked on was also not significant.

McGaghie (2015) describes traditional medical education as relying on direct patient care experiences as the primary training tool. This outdated teaching strategy is unable to assure clinical competence. Although Mastery Learning was reported in the 1960s, it is only now being applied to healthcare education (McGaghie, Issenberg, Barsuk, & Wayne, 2014). The application of the research outcomes which confirm the effectiveness of mastery learning as a teaching strategy are imperative because of the impact on improved patient outcomes with the potential of reducing cost to deliver care (McGaghie, Barsuk, & Wayne, 2015). Teaching healthcare professionals using the approach of "see one, do one, teach one" is no longer the most effective method of instructing others (McGaghie et al., 2014, p. 378).

In this study, the mean SASR score for the experimental group is greater than the mean for the control group suggesting that nurses in the experimental group reported a greater propensity for learning and applying study strategies to prepare for their clinical work. The subscale with the greatest difference was metacognition. Metacognition is a reflection of not only personal assessment of goals but setting, tracking and refining performance based on goal achievement (Dugan & Andrade, 2011). The metacognition

statement “I know when and where to use certain learning/studying strategies” affirms that new to practice nurses may contemplate using clinical resources (i.e. reference books, procedure manuals) to help achieve their learning goals when uncertain about the patient care they are providing.

Kuiper and Pesut (2004) reported the importance of introducing the theory of self-regulation when teaching both nursing students and practicing nurses in an effort to impact clinical reasoning and problem solving when providing care to patients. This introduction improves both cognitive (reasoning) and metacognitive (contemplating) skills and their application to the clinical environment. Mastery learning, which provides feedback and correctives, has the potential to assist new nurses to learn basic nursing skills first and then build on these skills in an effort to promote clinical competence. Feedback provides the learner with valuable evidence by comparing performance against a set standard and then identifying the knowledge gaps. This type of feedback, also a formative assessment, evaluates student knowledge and the effectiveness of their self-regulation strategies used to learn this new information allowing them to adjust their study tactics (Nicol & Macfarlane-Dick, 2006). This approach fosters confidence and an eagerness to engage in life-long learning and intrinsic motivation to ask for help when challenges arise (Tuttle, Sherrod, & Canzona, 2008), which is also a self-regulation strategy (Zimmerman & Pons, 1986).

3.7 Limitations and Future Research

Considerations for changes in the performance assessment process include the importance of setting clear performance expectations specifically for the mastery learning group at the initial assessment/intervention (Guskey, 2010). The use of a script stating the

performance goals and objectives at the start of the initial assessment could have also prevented inconsistent instruction between each nurse experts. In addition, this scripted instruction could have addressed the steps that were difficult to demonstrate, for example; spreading the legs, and provided instruction for how the participant should verbalize these steps regardless of the ability to demonstrate them. Some participants verbalized these steps and others omitted them making it difficult to mark them consistently on the PAT. Development of a script for the start of each session may have been beneficial.

Prior practice and knowledge of this procedure may have been a contributing factor in that some nurses talked about the amount of practice they had in their undergraduate program. A comparison for school experience and the transfer of knowledge to the work place may prove informative and is a potential future study question.

Although most participants did not find the additional time required for this study a burden, a few expressed some concern for the one-month assessment scheduled during work hours as compared to a class day or a day off. Future consideration for scheduling during prearranged class time may be useful. In addition, perhaps a qualitative analysis needs to be conducted to explore why the experimental group of nurses reported higher metacognition scores. A self-reflective question at the one-month assessment could be "What did you do to prepare for this one-month assessment?" This would provide some data about real-time self-regulation practices for each participant and reinforce those practices for the future.

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3.8 Appendix A

Performance Assessment Tool (PAT)

Which age group best describes you?

18-20 years old _____ 21-25 years old _____ 26-30 years old _____ 31-35 years old_____

36-40 years old _____41-45 years old _____ >45 years old _____

What is your gender?

Male _____ Female _____

What is your employment status?

Full time (80 hours/pay) _____ Part time (<80 hours/pay) _____

What type of clinical unit do you work on most often?

General Medical _____ Perioperative _____

Critical Care _____ Emergency care _____

Ambulatory care _____ Labor and Delivery _____

Procedural Steps for Female	Attempt 1	Attempt 2	Attempt 3	Attempt 4	Comments
Performed hand hygiene before patient contact.	☐	☐	☐	☐	
Verified the correct patient using two identifiers.	☐	☐	☐	☐	
Closed curtain or door to provide privacy for the patient.	☐	☐	☐	☐	
Assessed the patient's clinical status: a. Time of last urination b. Intake and output: c. Level of awareness or developmental stage d. Mobility and physical limitations e. Age f. Allergies, specifically to latex or povidone-iodine	☐	☐	☐	☐	
Assessed bladder for fullness.	☐	☐	☐	☐	

Performed hand hygiene, donned gloves, and assessed for perineal anatomic landmarks, erythema, drainage, and odor. Removed gloves and performed hand hygiene.	☐	☐	☐	☐	
Reviewed the patient's record for any pathologic condition that might impede passage of the catheter.	☐	☐	☐	☐	
Catheter Insertion Performed hand hygiene and donned gloves.	☐	☐	☐	☐	
Raised the bed to an appropriate working height. Facing the patient, stood on the left side of the bed if right-handed and on the right side if left-handed. If there were side rails, raised the side rail on the opposite side of the bed and lowered the side rail on the working side.	☐	☐	☐	☐	
Placed a waterproof pad under the patient.	☐	☐	☐	☐	
Positioned the patient. a. Assisted the patient to a dorsal recumbent position (supine with knees flexed). Asked the patient to relax thighs to externally rotate the hip joints. b. If the patient could not be supine, positioned in side-lying position with upper leg flexed at knee and hip. i. Took extra precautions to cover rectal area with a drape during the procedure to reduce risk of cross contamination. ii. Supported the patient with pillows if necessary to maintain position.	☐ ☐	☐ ☐	☐ ☐	☐ ☐	
Covered the patient with a bath blanket. Placed the blanket in a diamond-shape configuration over the patient, with one corner at the patient's	☐	☐	☐	☐	

neck, side corners over each arm and side, and the last corner over the perineum.					
Washed the perineal area with soap and water, located urinary meatus, and dried it. Had an assistant hold an alternative light source to illuminate the perineum as needed.	☐	☐	☐	☐	
Discarded used supplies, removed gloves, and performed hand hygiene.	☐	☐	☐	☐	
Opened outer wrapping of either an indwelling catheterization kit or an intermittent catheterization kit. a. Tore package on paper-lined edge of plastic wrap. ☐ b. Placed inner wrapped box on easily accessible, clean bedside table or set it between the patient's legs. ☐ c. Placed the empty outer plastic wrap near the end of the bed and used for waste disposal. ☐					
Opened the sterile inner package containing catheter supplies. Using sterile technique, folded back each flap of the sterile package one at a time, with the last flap opened toward the nurse.	☐	☐	☐	☐	
Placed waterproof sterile drape (when packed as first item in tray). a. Removed the square sterile drape from the tray, touching the edges only. Did not touch any other item in the kit. ☐ b. Keeping the drape sterile, let it unfold after removing from tray. Folded top edge of drape away from the patient to form a cuff over both hands. ☐ c. Had the patient lift her hips. If the patient was unable to lift her hips, had an assistant lift the patient's hips. ☐					

d. Placed the sterile drape with the plastic (shiny) side down under the patient's buttocks.	☐	☐	☐	☐	
Donned sterile gloves (when packed as first item in tray, donned and then placed square drape).	☐	☐	☐	☐	
Applied the fenestrated drape. a. Lifted the fenestrated sterile drape out of the tray. Allowed it to unfold without touching a nonsterile surface. b. Formed a cuff from the edges to protect sterile gloves. c. Applied the drape over the perineum, exposing the labia; did not touch any contaminated surface.	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	
Moved the tray or box on the sterile field closer to the patient and organized remaining items on sterile field. Formed a continuous sterile field with the sterile wrap under the tray or box and the drape under the patient.	☐	☐	☐	☐	
Prepared items for indwelling catheter with a preassembled closed urinary drainage system: a. Checked for a secure connection at the tubing and catheter connection site. b. If recommended by the manufacturer, tested the catheter balloon by injecting fluid from the prefilled sterile water syringe into the balloon port. c. Loosened the lid on the sterile specimen container if a urine specimen was required; otherwise, discarded the container in the waste-disposal bag. d. Opened the package of sterile antiseptic solution and poured solution over the sterile cotton balls. If sterile antiseptic swabs	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	

were supplied instead of solution, opened the package with the stick ends up for access. e. Opened the packet containing lubricant and squeezed it onto the sterile field. If the lubricant was supplied in a prefilled syringe, removed protective cap and injected the lubricant into the sterile tray.	☐	☐	☐	☐	
Placed the catheter tip into lubricant.	☐	☐	☐	☐	
Cleansed the urethral meatus. a. With the nondominant hand: i. Fully exposed the urethral meatus by spreading the labia. ii. Had an assistant use a flashlight if unable to visualize the meatus with available lighting. iii. Maintained the position of the nondominant hand throughout the procedure. If unable to visualize the urethra, placed one finger of the gloved, nondominant hand inside the vagina and applied gentle pressure upward to support and straighten the urethra. Inserted the catheter just above the finger and below the clitoris. Ensured that the patient understood what was being done. b. With the dominant hand: i. Grasped an antiseptic-soaked cotton ball with forceps or picked up an antiseptic swab stick. ii. Cleaned the perineal area, wiping front to back from	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	

the clitoris toward the anus. iii. Used a new cotton ball or swab for each area cleansed. iv. Wiped the far labial fold first, the near labial fold next, and then directly over center of the urethral meatus. If the labia were allowed to close during cleansing, repeated the cleaning procedure.	☐ ☐	☐ ☐	☐ ☐	☐ ☐	
With the sterile dominant hand, picked up the catheter. Held the catheter loosely coiled in the palm of the dominant hand.	☐	☐	☐	☐	
Inserted the catheter. a. Asked the patient to bear down gently as if to void, and slowly inserted the catheter through the urethral meatus. b. Advanced the catheter approximately 5 to 7.5 cm or until urine flowed through the catheter and out. c. As soon as urine flowed out of the end of the catheter, advanced the catheter approximately 2.5 to 5 cm. If no urine appeared, left the catheter temporarily in the vagina as a landmark indicating where not to insert the next catheter, and inserted another sterile catheter. d. Did not force the catheter against resistance. e. Released the labia, and held the catheter securely with the nondominant hand.	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	
Fully inflated the balloon of the indwelling catheter per the manufacturer's instructions.					

a. While holding the catheter with the nondominant hand at the urethral meatus, took the end of the catheter with the dominant hand and placed the catheter between the first two fingers of the nondominant hand. Maintained a secure hold on the catheter with the nondominant hand. b. With the free dominant hand, connected the inflation syringe to the end of the catheter at the inflation valve and slowly injected the required amount of solution. Followed the manufacturer's instructions regarding the amount of fluid to use for balloon inflation. If resistance was met when inflating the balloon or the patient verbalized or showed nonverbal signs of pain, stopped inflation; gently aspirated the fluid back into the syringe, and advanced the catheter a little more before reattempting to inflate. c. After inflating the balloon, pulled *gently* on the catheter tubing until resistance was felt. d. Placed the drainage bag below the level of the bladder. Did not place the bag on the side rails. Ensured that there were no dependent loops in the tubing.	☐	☐	☐	☐	
Allowed the bladder to empty completely unless the organization's practice restricted maximal volume of urine allowed to be drained with each catheterization.	☐	☐	☐	☐	
Anchored the catheter. a. Secured the catheter tubing to the patient's inner thigh with a securement device.	☐	☐	☐	☐	

b. Created slack when securing the catheter so that movement of the thigh did not create tension on the catheter. c. Clipped the drainage tubing to the edge of the mattress.	☐ ☐	☐ ☐	☐ ☐	☐ ☐	
Coiled any excess tubing on the bed, and fastened it to the bottom sheet with a clip from the kit or with a rubber band and safety pin.	☐	☐	☐	☐	
Obtained a sterile specimen as needed from the most proximal port using aseptic technique.	☐	☐	☐	☐	
Observed the characteristics and amount of urine in the drainage system.	☐	☐	☐	☐	
Assessed for urine leak from catheter or tubing connections.	☐	☐	☐	☐	
Completing the Procedure Discarded used supplies, removed gloves, and performed hand hygiene.	☐	☐	☐	☐	
Assisted the patient to a comfortable position. Lowered the bed and return the side rails to the original positions.	☐	☐	☐	☐	
Assessed, treated, and reassessed pain.	☐	☐	☐	☐	
Performed hand hygiene	☐	☐	☐	☐	
Documented the procedure in the patient's record.	☐	☐	☐	☐	

*Highlighted steps = critical steps

Nurse Expert: _____ Signature: _____

Print Name

Date: ____ / ____ / _____

3.9 Appendix B

Survey of Academic Self-Regulation Questionnaire

Survey Items

*The following items assess your learning and study strategy use. Please indicate your level of agreement with the statements below by **circling** the appropriate number that corresponds with the following scale:*

1-**S**trongly **D**isagree 2-Disagree 3-Slightly Disagree 4-Slightly Agree 5-Agree 6-**S**trongly **A**gree

Metacognition		**St D**					**St A**
1	When I don't know the steps of a clinical procedure, I slow down or change strategies.	1	2	3	4	5	6
2*	I use the available aids like procedure checklists.	1	2	3	4	5	6
3	I review the effectiveness of my approach after I finish a task.	1	2	3	4	5	6
4	I try to assess how well I have accomplished my patient care goals when finished.	1	2	3	4	5	6
5	I know when and where to use certain learning/studying strategies.	1	2	3	4	5	6
6*	I set goals for myself before I start providing care.	1	2	3	4	5	6
7*	I keep track of how well I understand my clinical preceptor.	1	2	3	4	5	6
8*	I keep track of the resources available for providing patient care	1	2	3	4	5	6
9	When learning is boring I find ways to make it interesting.	1	2	3	4	5	6
10	I study first and then reward myself later.	1	2	3	4	5	6
11	I try to summarize what I am reading or hearing.	1	2	3	4	5	6
12	I test myself to check my understanding of material I've been studying.	1	2	3	4	5	6
13	I tell myself that I need to keep studying in order to do well.	1	2	3	4	5	6
14	I go beyond what is required to see how much I can learn.	1	2	3	4	5	6
15	I think of several ways to solve a problem and choose the best one.	1	2	3	4	5	6
16	I reflect on how well I am controlling my learning/studying.	1	2	3	4	5	6
17	I keep studying until I have achieved a certain goal.	1	2	3	4	5	6
18	I use specific test-taking strategies.	1	2	3	4	5	6

1-**S**trongly **D**isagree 2-Disagree 3-Slightly Disagree 4-Slightly Agree 5-Agree 6-**S**trongly **A**gree

Extrinsic Motivation		**St D**					**St A**
19	It's important that others see me as intelligent.	1	2	3	4	5	6
20	I often try to show others how capable I am.	1	2	3	4	5	6
21*	I want to show I am more able than others on my clinical unit.	1	2	3	4	5	6
22*	I want to know more than other new nurses.	1	2	3	4	5	6
23	It's important for me not to appear "stupid" to others.	1	2	3	4	5	6

1-**S**trongly **D**isagree 2-Disagree 3-Slightly Disagree 4-Slightly Agree 5-Agree 6-**S**trongly **A**gree

Self-Regulation		**St D**					**St A**
24	I have set high academic standards for myself.	1	2	3	4	5	6
25	I find it hard to complete tasks once I start.	1	2	3	4	5	6
26	I complete tasks even when they are boring or uninteresting.	1	2	3	4	5	6
27*	I find excuses for not doing my patient care assignments/tasks.	1	2	3	4	5	6
28	I pretend the work is easy even when it isn't.	1	2	3	4	5	6
29	I study in places where I can concentrate.	1	2	3	4	5	6
30	I put off studying because I am afraid of failing.	1	2	3	4	5	6
31	I spend too much time with friends when I should be studying.	1	2	3	4	5	6
32*	I prepare for work regularly.	1	2	3	4	5	6
33	I keep up with readings and tasks.	1	2	3	4	5	6
34	I organize my time in order to accomplish my goals.	1	2	3	4	5	6
35	I know help is available if I need it.	1	2	3	4	5	6

1-**S**trongly **D**isagree 2-Disagree 3-Slightly Disagree 4-Slightly Agree 5-Agree 6-**S**trongly **A**gree

Personal Relevance & Control		**St D**					**St A**
36	I am confident I can manage my own learning.	1	2	3	4	5	6
37	I have the means to achieve the goals set for me.	1	2	3	4	5	6
38*	I know what my preceptor expects of me.	1	2	3	4	5	6
39	I focus on the important concepts and/or main ideas when studying.	1	2	3	4	5	6
40*	I expect to do well on this clinical unit.	1	2	3	4	5	6

41	I reconsider my assumptions when something doesn't work.	1	2	3	4	5	6
42	I have control over how much I learn.	1	2	3	4	5	6
43	I evaluate the evidence when presented with a theory or interpretation.	1	2	3	4	5	6
44	I think about my options if something doesn't go the way I plan.	1	2	3	4	5	6
45	I try to relate what I am learning to what I already know.	1	2	3	4	5	6
46	I consider alternative points of view about a topic.	1	2	3	4	5	6

1-**S**trongly **D**isagree 2-Disagree 3-Slightly Disagree 4-Slightly Agree 5-Agree 6-**S**trongly **A**gree

Intrinsic Motivation		**St D**					**St A**
47	I prefer tasks that are challenging.	1	2	3	4	5	6
48*	I care very much about being on this clinical unit and hospital.	1	2	3	4	5	6
49*	I find preparing for my patients enjoyable.	1	2	3	4	5	6
50	What I am learning is relevant to my life.	1	2	3	4	5	6
51	I want to master the things I am learning.	1	2	3	4	5	6
52	I can connect what I am learning to my own life experiences.	1	2	3	4	5	6
53	I like to learn just for the sake of learning.	1	2	3	4	5	6
54	Studying is fun for me.	1	2	3	4	5	6
55*	Studying about my patients will help me to achieve my goals.	1	2	3	4	5	6

1-**S**trongly **D**isagree 2-Disagree 3-Slightly Disagree 4-Slightly Agree 5-Agree 6-**S**trongly **A**gree

Self-Efficacy		**St D**					**St A**
56	I can understand even the most difficult material.	1	2	3	4	5	6
57*	I know that I will do well as a nurse.	1	2	3	4	5	6
58	I have negative thoughts about my academic abilities.	1	2	3	4	5	6
59*	I worry about doing more poorly than other new nurses on my clinical unit	1	2	3	4	5	6
60	I find it hard to concentrate when I am studying.	1	2	3	4	5	6
61	I am afraid of looking stupid when I ask a question.	1	2	3	4	5	6
62	I can't concentrate on the task when I get nervous.	1	2	3	4	5	6

63*	I feel nervous even when I am prepared for a patient care assignment.	1	2	3	4	5	6

Notes: 1. SASR items in red are reverse-scored prior to scoring
2. Those with an * have been revised with permission from the author to fit the study population, nurses.

This tool was adapted and with permission by Dugan, R. F., & Andrade, H. L. (2011). Exploring construct validity of academic self-regulation using a new self-report questionnaire – The survey of academic self-regulation. *The International Journal of Educational and Psychological Assessment, 7*(1), 127-139.

3.10 Table 1.

Data Collection Process

	Experimental Group	Control Group
Baseline	Completed self-paced computerized instructional learning module	Completed a self-paced computerized instructional learning module
PAT: Initial Assessment	Completed the nursing procedure for insertion of an indwelling urinary catheter on a task simulator as many times as it takes to complete the task with zero prompts given by the expert nurse. Assessed by an expert nurse, the number of prompts required to complete the skill correctly was documented on the participant's PAT. The expert nurse provided immediate individualized feedback and correctives to the participant after each performance error. If a	Completed the nursing procedure for insertion of an indwelling urinary catheter on a task simulator one time. Assessed by an expert nurse, the number of prompts required to complete the skill correctly was documented on the participant's PAT. The expert nurse provided individualized feedback and correctives to the participant at the conclusion of the session.

	performance error occurred at one of the 17 critical steps, the participant was asked to stop and received immediate feedback on the step performed incorrectly and then asked to perform the entire procedure again starting at the beginning.	
Average Time	25.7 minutes (SD = 11.58)	15 minutes (SD = 4.36)
PAT: One-month Assessment	Completed the skill of insertion of an indwelling urinary catheter on a task simulator. Assessed by an expert nurse, the number of prompts required to complete the skill correctly and according to the procedure, was documented on the PAT.	Completed the skill of insertion of an indwelling urinary catheter on a task simulator. Assessed by an expert nurse, the number of prompts required to complete the skill correctly and according to the procedure, was documented on the participant's PAT.
Average Time	10.46 minutes (SD = 2.29)	10.46 minutes (SD = 2.29)

ASR	Completed a pen and paper self-report questionnaire at one-month assessment	Completed a pen and paper self-report questionnaire at one-month assessment
Average Time	7.14 minutes (SD = 1.99)	7.14 minutes (SD = 1.99)

3.11 Table 2.

Descriptive Statistics

Variable		Group	
		Control (n=20)	Experimental (n=19)
Age Group	21-25	50.0%	52.6%
	26-30	40.0%	26.3%
	31-35	5.0%	5.3%
	36-40	0.0%	5.3%
	41-45	5.0%	10.5%
Gender	F	75.0%	84.2%
	M	25.0%	15.8%
Employment	Full Time	100.0%	100.0%
Clinical Unit	Critical Care	0.0%	21.1%
	Emergency	5.0%	5.3%
	General Medical	75.0%	63.2%
	Labor &Delivery	5.0%	0.0%
	Perioperative	15.0%	10.5%
# of Insertions After	0	80.0%	78.9%
Training	1	20.0%	15.8%
	2	0.0%	5.3%

3.12 Table 3.

Initial vs One-Month PAT Scores

Group	Initial M ± (SD)	One-Month M ± (SD)	*t*	Sig. (2-tailed)
Control	46.55 (8.575)	50.65 (9.516)	1.590	.128
Experimental	55.26 (7.571)	52.32 (7.499)	-1.127	.275

$p < .05$ (significant)

3.13 Table 4.

Initial vs One-Month Mean Change in PAT Scores

Change in score M ± (SD)			
Control	Experimental	*t*	Sig. (2-tailed)
4.10 (11.530)	-2.95 (11.404)	1.918	0.63

$p < .05$ (significant)